1800

Microcomputer Compatible with the IBM Personal Computer AT™

OPERATION MANUAL

VERSION 2.2

MAN-00036-22

1800

Microcomputer compatible with the IBM Personal Computer AT™

OPERATION MANUAL
(VERSION 2.2)

Notice

IBM Personal Computer AT and XT are trademarks of International Business Machines Inc.

Lotus 1-2-3 and Symphony are trademarks of Lotus Development Corp.

Hercules Graphics Card is a trademark of Hercules Computer Technology.

Evergraphics, Enhanced Evergraphics, Enhancer, Edge, and Graphics Edge are trademarks of Everex Systems Inc.

Atasi, Cogito, Fuji, Fujitsu, Maxtor, Micropolis, Microscience, Miniscribe, MMI, Quantum, Qume, Rodime, Seagate, Tandon, Tulin and Vertex are trademarks of their respective companies.

Warning

Class B Computing Device

WARNING: This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, it may cause interference with radio and television reception. It has been certified and found to comply with the limits for a Class B computing device in accordance with the specifications of Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Re-orient the receiving antenna
2. Re-orient the computer with respect to the receiver
3. Move the computer away from the receiver
4. Plug the computer into a different outlet so that computer and receiver are on different branch circuits
5. Ensure that the card mounting screws, attachment connector screws, and ground wires are tightly secured.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio TV Interference Problems." This booklet is available from the U.S. Government Accounting Office, Washington, DC 20401, Stock No. 004-000-00345-4 (FCC, Part 15.838 b).

Notes

Table of Contents

Chapter I: Installation

Carefully unpack your 1800 from its carton and verify that you have received each of the following:

- The 1800 system unit
- A keyboard in a separate box
- One software diskette
- This manual
- Two plastic slide rails (for optional hard disk drive)
- One power cable
- Cardboard and foam packing materials

If any of these parts is missing, contact the dealer who sold you the 1800.

NOTE: Save the carton and packing materials that accompany your 1800! If you ever decide to move or ship the 1800 you will need these to protect against shipping damage. As with any major purchase you make, save the sales invoice.

1.INTRODUCTION

The 1800 is a high-performance, expandable, upgradeable microcomputer which uses the same 16-bit microprocessor as the IBM AT. The 1800 comes standard with the following:

- High-capacity 1.2 megabyte floppy disk drive
- Combination hard disk drive and floppy disk drive controller card
- 84-key adjustable keyboard
- SETUP software
- Socket for 80287 math coprocessor
- Six 16-bit expansion slots and two 8-bit expansion slots
- Runs at 6 or 8 MHz clock speed
- 192 watt power supply, switchable from 110 to 220 volts

The 1800 does not include a display adapter, monitor, hard disk drive, or disk operating system (DOS). These must be purchased separately.

2. HOW TO USE THIS MANUAL

The first Chapter of this manual will guide you through the set-up and installation of your 1800. *All users should read Chapter I.*

Chapters II and III describe some of the various enhancements and peripherals that you can add to the 1800. The only parts that you *must* add to the 1800 before you can run it are a monitor and display adapter.

Chapter IV gives basic information about the keyboard.

Chapter V contains tips for identifying and solving some common errors. If you experience any kind of failure, turn to Chapter V. In all likelihood, your problem will have a simple solution.

Chapter VI is for people who have never used a computer before. It contains tips on basic operation as well as some background information on how computers work. If you are a new user, you may want to skip directly to Chapter VI before reading the rest of this manual.

Appendices I through III contain technical reference information on all the components of the 1800.

Appendix IV lists four simple procedures for you to follow when you want to move the 1800. These procedures are essential for the safe transportation of your 1800, *especially if you have a hard disk.*

3. PREPARATION

Before you begin to install your 1800, you should have a large clear space on which to work. You will need the following:

- A grounded power outlet
- A small Phillips screwdriver
- A small pair of scissors or a pocket knife
- A plastic cup or ashtray to hold loose screws
- Tweezers or small pliers
- A pen or pencil

Set the 1800 system unit on a level surface and examine the following features:

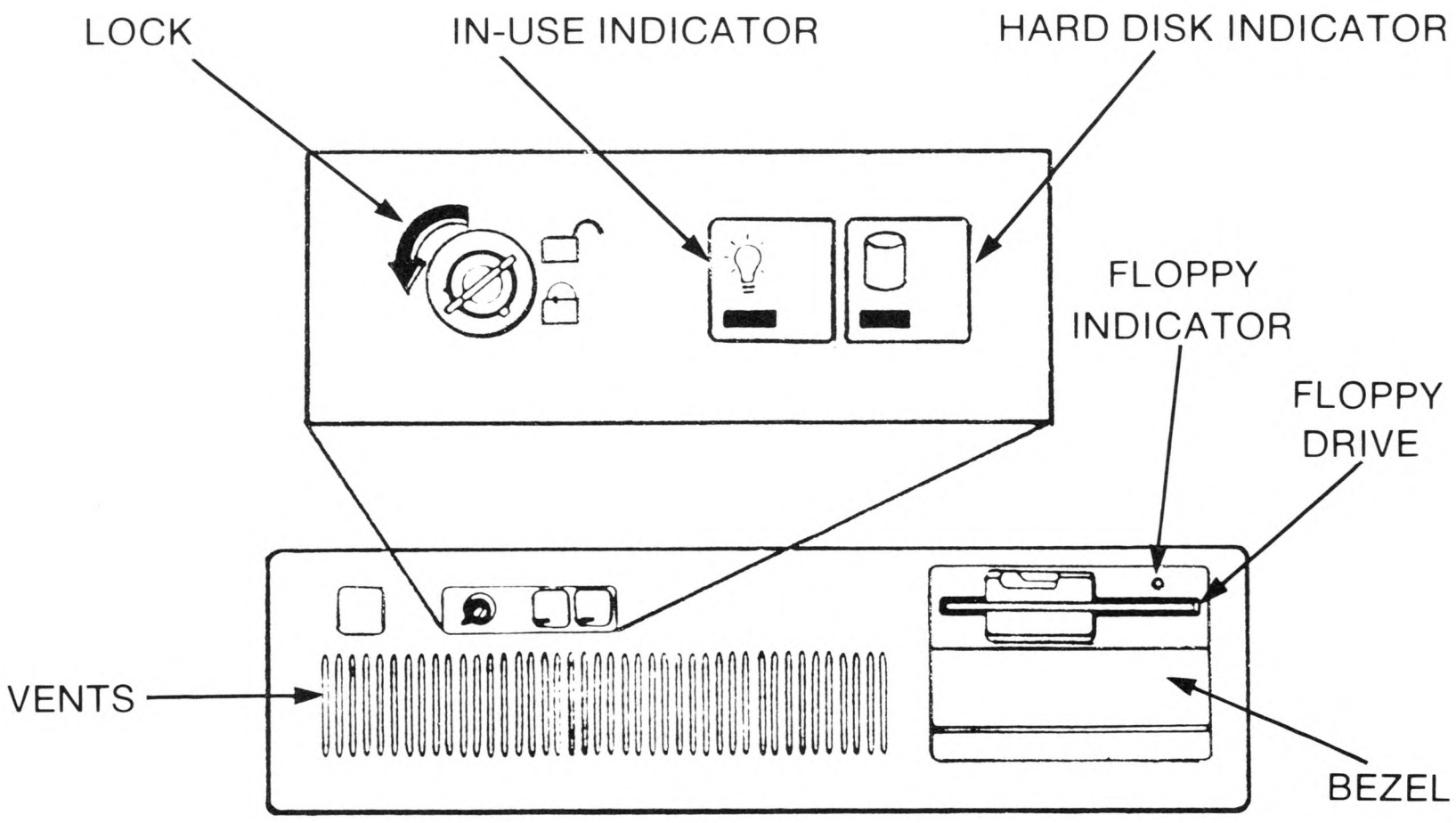


Figure 1: The front of the 1800

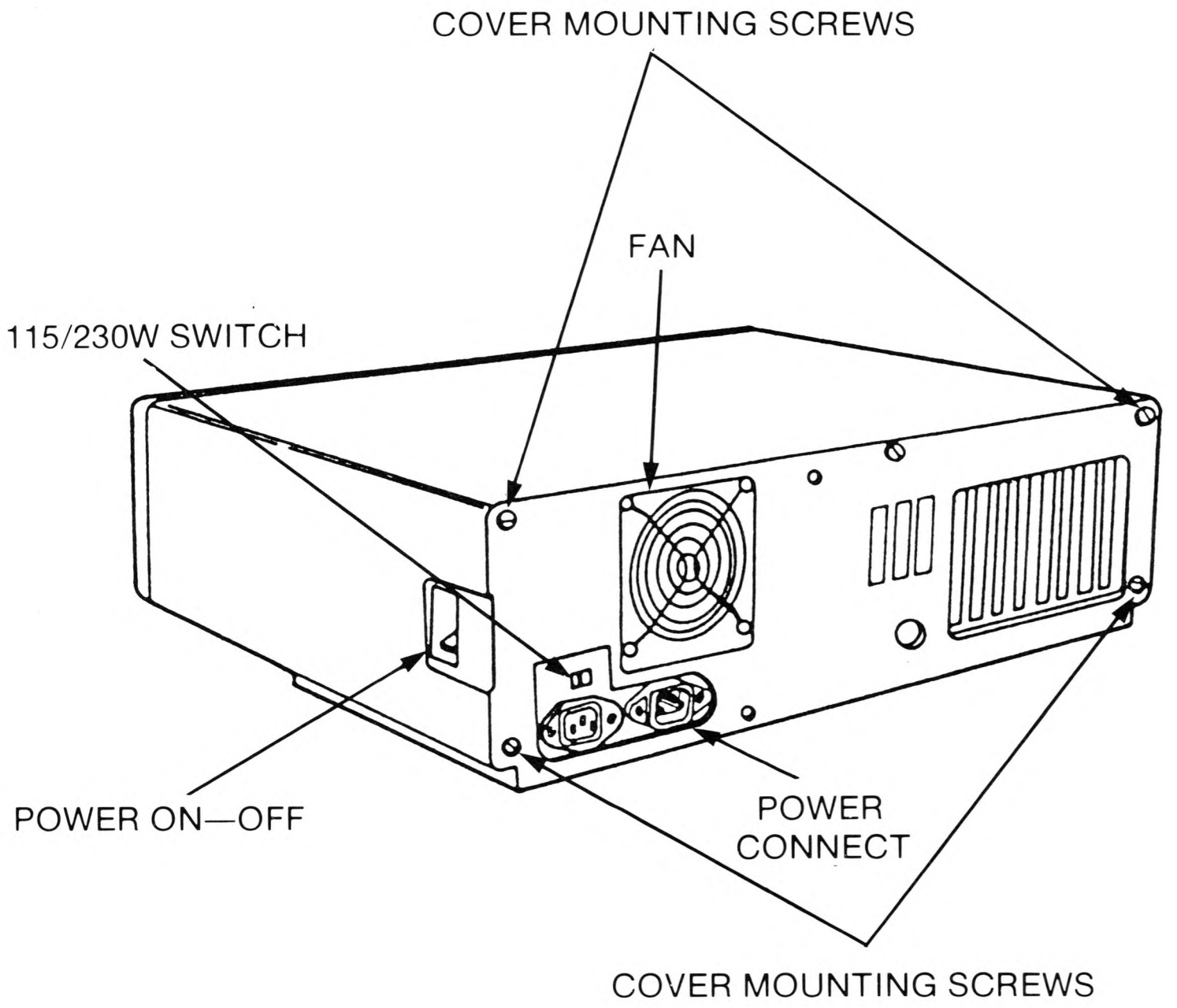


Figure 2: The back and side of the 1800

Carefully snip away the plastic band which holds the keys in place. Insert a key in the lock on the front of the 1800, and turn it clockwise to lock. In this position, the keyboard is disabled and the cover cannot be removed. Turn the key back to unlock the system, and put the keys away in a safe place.

Locate and remove the five cover mounting screws on the back of the 1800 chassis.

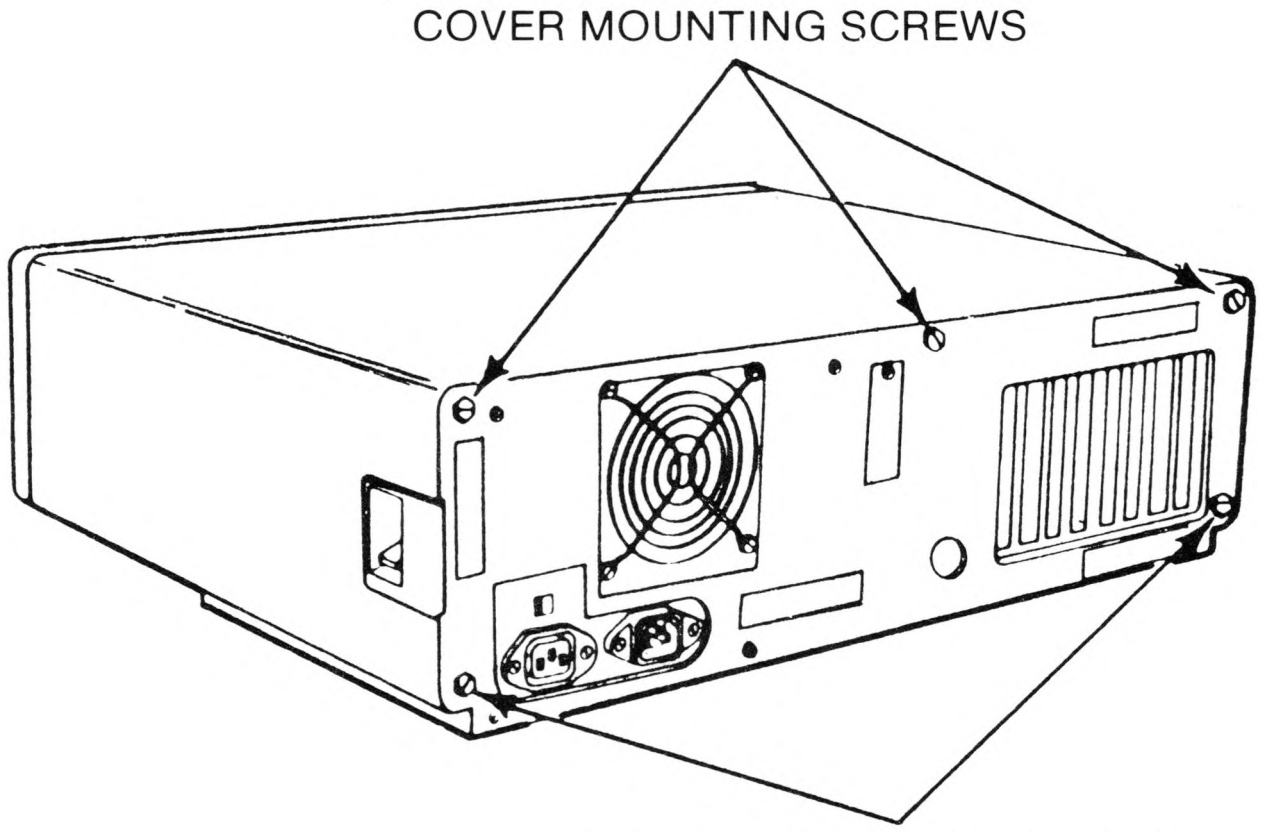


Figure 3: Cover mounting screws

Put the screws in a safe place.

Grasp the cover of the chassis in both hands and slide it forward and off, as shown. There are several ribbon cables present in the system. If you encounter any resistance as you're taking off the system unit cover, reach in and gently press down on these cables. Do not attempt to yank off the cover when it may be caught on a cable.

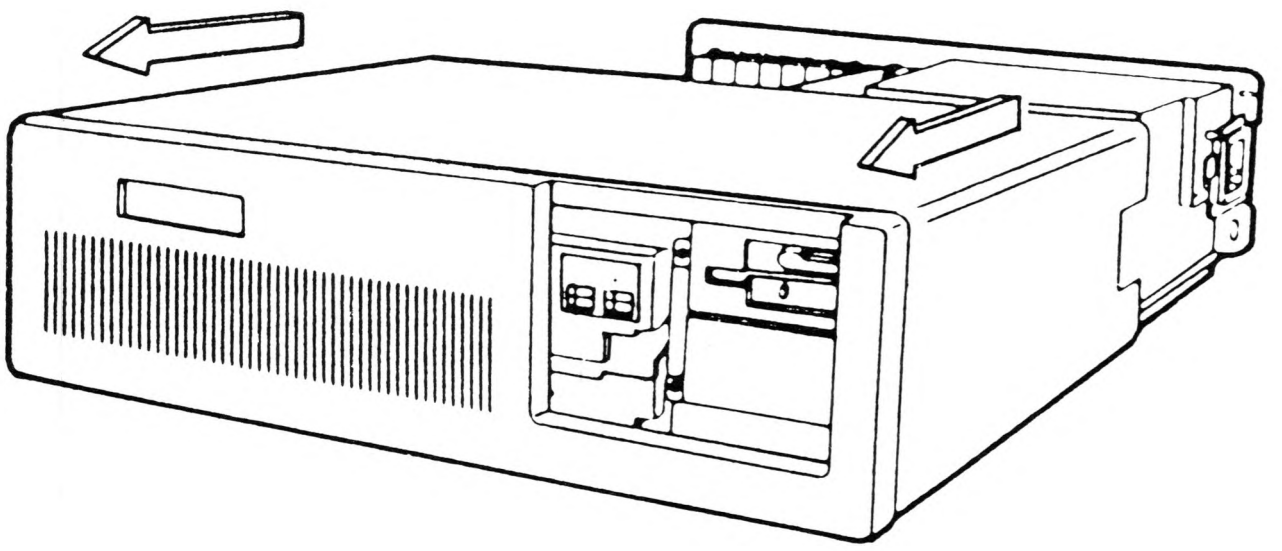


Figure 4: Removing the cover of the 1800

To familiarize yourself with the 1800's internal parts, look around the chassis and locate the major features.

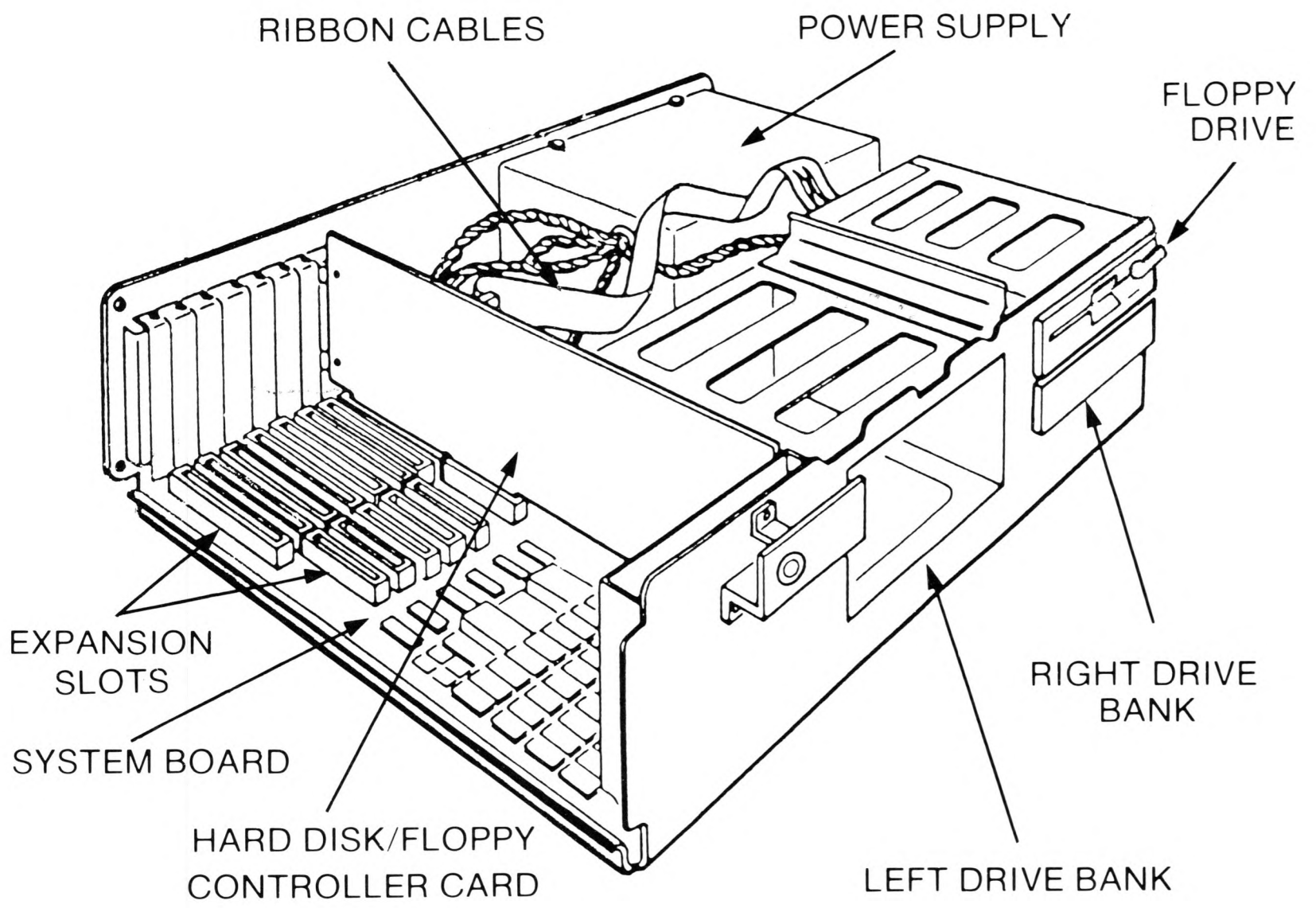


Figure 5: Inside the 1800

The 1800 comes configured for a monochrome display adapter and monitor. If you are going to install a color display adapter and monitor, you should set switch W3 according to Figure 6 below.

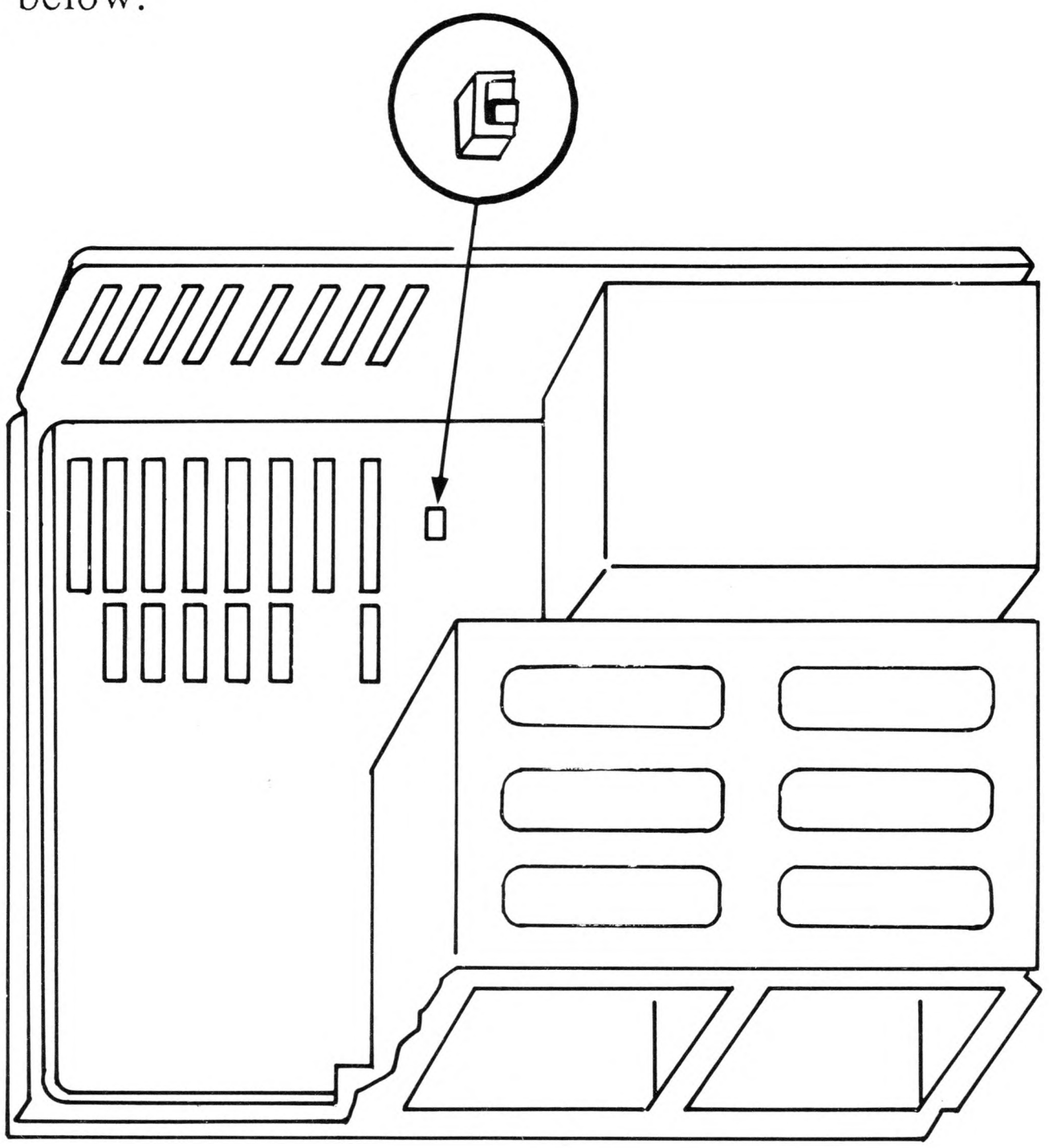


Figure 6: W3 in the 1800

W3 is a single slide switch. When the switch is toward the back of the 1800 chassis, the computer is set for monochrome. When the switch is toward the front, the computer is set for color.

TABLE 1

POPULAR DISPLAY ADAPTERS AND W3 SETTINGS

CARD NAME	CARD TYPE	SWITCH W3 SETTING
EVERGRAPHICS	MONOCHROME	BACK
HERCULES GRAPHICS CARD	MONOCHROME	BACK
IBM MONOCHROME DISPLAY ADAPTER AND PRINTER ADAPTER	MONOCHROME	BACK
HERCULES COLOR CARD	COLOR	FRONT
IBM COLOR GRAPHICS ADAPTER	COLOR	FRONT
ENHANCED EVERGRAPHICS	ENHANCED AND MONOCHROME	FRONT, EVEN IF BOOTING IN MONO MODE

CARD NAME	CARD TYPE	SWITCH W3 SETTING
ENHANCER	ENHANCED	FRONT
IBM ENHANCED GRAPHICS ADAPTER	ENHANCED	FRONT
EDGE	COMBINATION	FRONT IF CARD IS IN COLOR MODE; BACK IF BOOTING IN MONO MODE
GRAPHICS EDGE	COMBINATION	FRONT IF CARD IS IN COLOR MODE; BACK IF BOOTING IN MONO MODE

4. PERIPHERALS AND ENHANCEMENTS

The only components you need to add to your 1800 before you can run it are a display adapter and monitor. However, because the 1800 is a very flexible and easily expandable system, there are many other options that you can add to increase its performance. Most people will be interested in at least some of these options.

The available options for the 1800 are divided into two rough categories: **enhancements**, which are individual parts added directly to the 1800 system board, and **peripherals**, which are independent products. Chapter II gives you the details of all the possible enhancements and how to install them. The enhancements discussed in Chapter II are the only ones you can add the to 1800; there are no others. Chapter III tells you about several types of peripherals that you can add to the 1800, but the list is only a partial one. New AT-compatible peripherals are constantly being invented.

5. STARTING UP THE 1800

1. When you have finished installing your enhancements and peripherals, slide the cover back on your 1800 and replace the cover mounting screws.

2. Unpack the keyboard box. Save the carton and packing materials in case you need to ship the keyboard.

   The keyboard's spiral cable goes into a five-pin port on the back of the 1800.

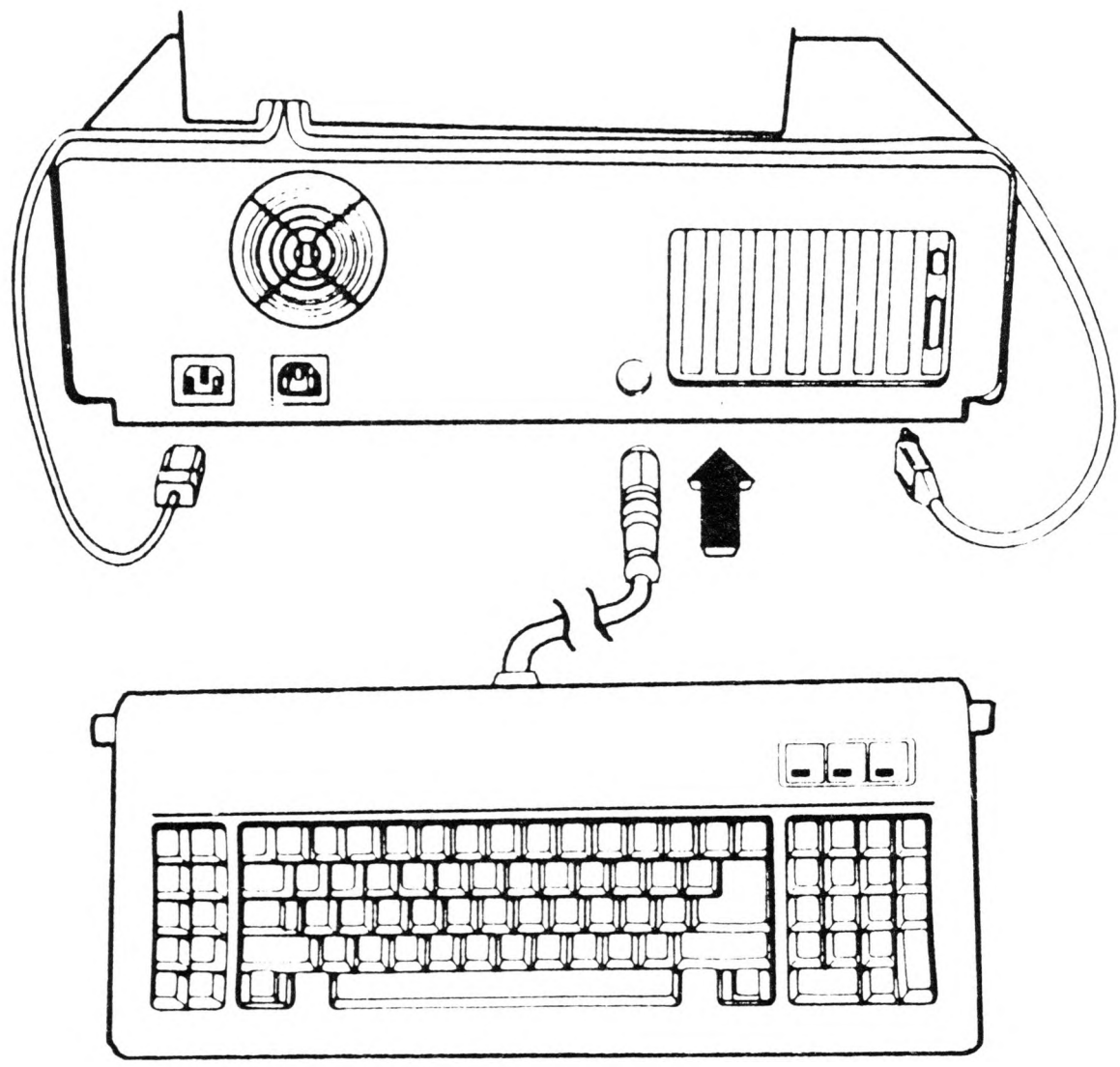


Figure 7: Plugging in the 1800 keyboard

Note that the pins in the keyboard plug must be lined up with the holes in the port in order to be installed.

For detailed information about the keyboard, turn to Chapter IV and Appendix III.

3. Next, plug in your monitor to the endplate of your display adapter.

4. Plug your monitor's power cable into its port as shown.

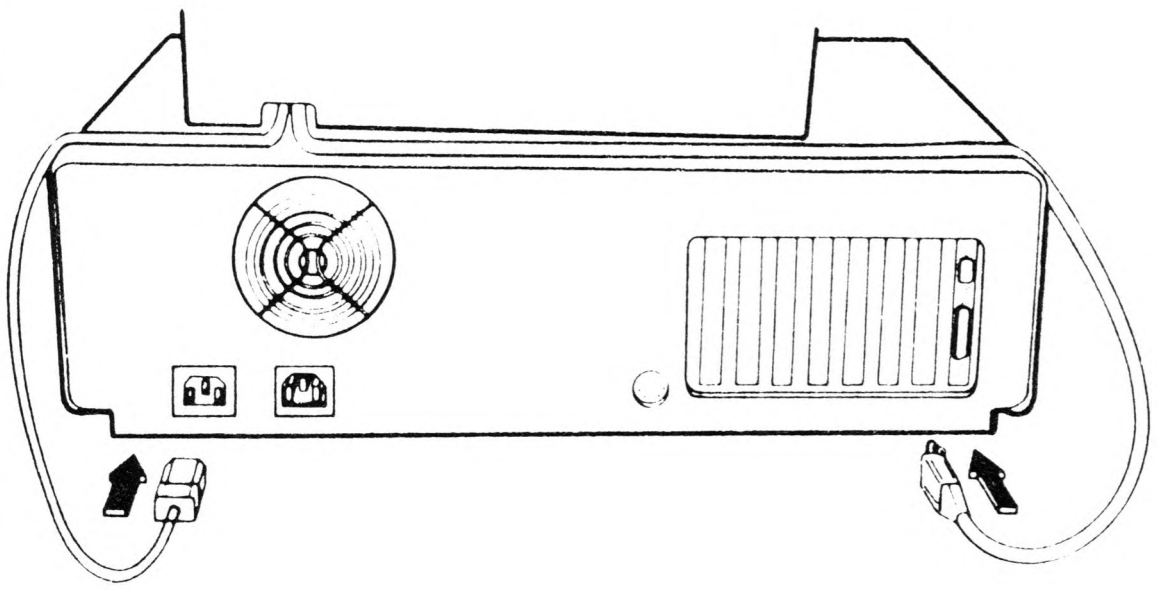


Figure 8: Plugging in the monitor's power cable

5. Finally, insert the main power cable that comes with the 1800 into its port and plug the other end into a grounded wall outlet.

6. Flip up the lever on the floppy disk drive and remove the sheet of shipping cardboard. Save the cardboard in case you decide to move the 1800. Insert your DOS diskette (DOS stands for Disk Operating System, and is sold separately) into the floppy drive, label side up. The oval opening in the jacket should go in first. When the diskette is all the way in, move the lever back down to close the drive door.

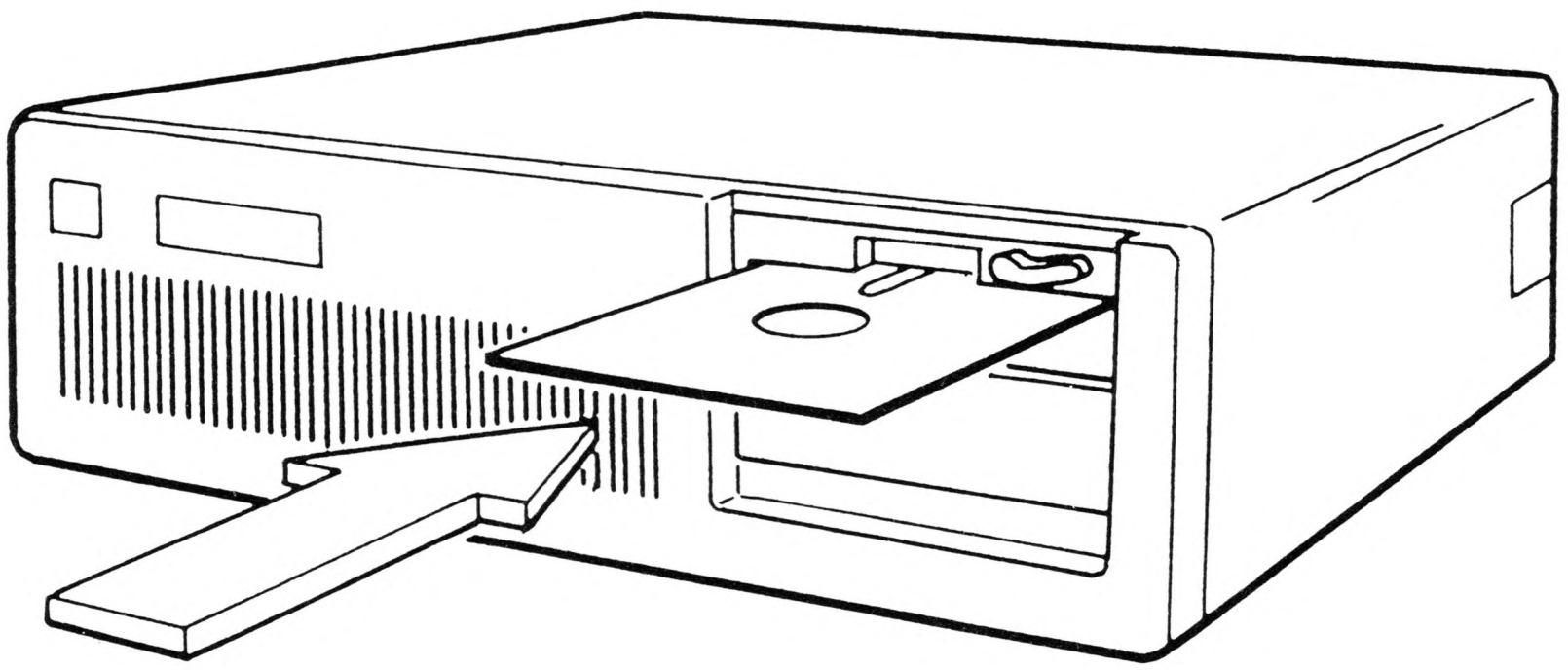


Figure 9: Inserting a diskette in the floppy drive

7. Check the front panel to be sure that the system is not locked.

8. Turn the monitor ON.

9. Move the 1800's power switch to the ON position.

NOTE: If you have a hard disk you will get a hard disk error message. This is because your hard disk is not yet formatted, and your 1800 cannot read it. Disregard the error for now.

The 1800 should now boot up and display a DOS message, followed by an A> prompt.

10. When you see the A>, remove the DOS diskette from drive A, and insert the SETUP utility diskette that comes with the 1800. Run SETUP, making sure you select your hard disk drive type (see PERIPHERALS below) before you attempt to format the disk.

Chapter II: Enhancements

Enhancements are individual parts that you can add to your 1800's system board to change or improve its performance. These are different from *peripherals*, which are complete products you add in.

This Chapter lists the three possible enhancements that you can make to your 1800. The parts required for each enhancement may be obtained via your computer dealer. No special tools are required to install any of them.

1. SYSTEM BOARD RAM

The 1800 comes with 512K RAM on the system board. This amount may be upgraded to 640K or to 1 Mb, or downgraded to 256K using 64K chips.

In addition to its system board RAM, the 1800 can hold up to 15 Mb of extended memory on add-in cards. These cards are discussed separately in CHAPTER III: PERIPHERALS.

The system board RAM chips are arranged in four rows in the right front quadrant of the chassis.

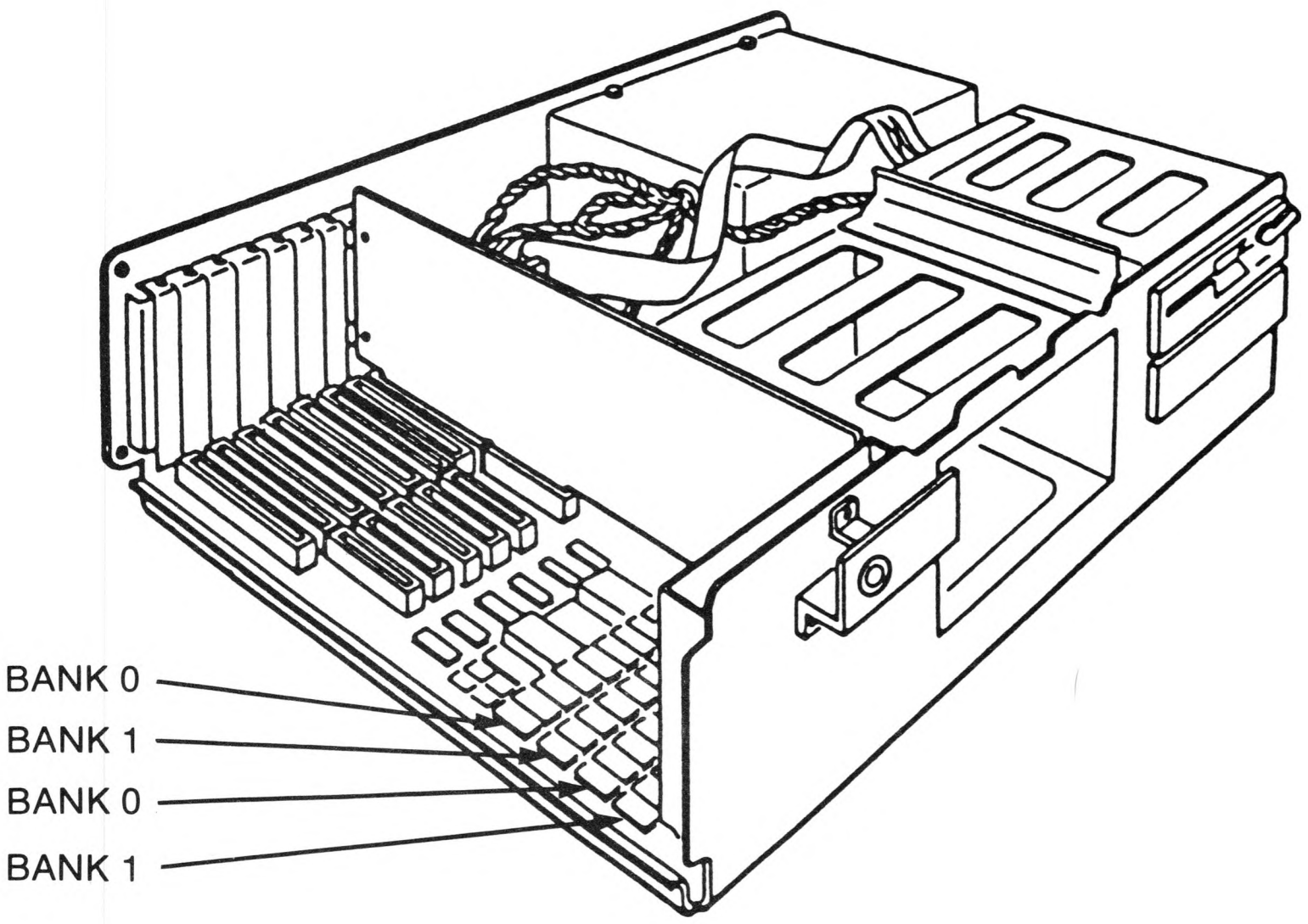


Figure 10: RAM Chip Banks in the 1800

These four rows make up two logical banks. As you count from the front of the chassis, the first and third rows comprise bank 1 while the second and fourth rows comprise bank 0.

Each bank must be either completely full or completely empty. You may never leave one row or part of a row empty.

The 1800 can use 64K or 256K RAM chips. The manufacturer recommends selecting only chips with speed 150ns or faster.

The RAM chip configuration of the 1800 is selected by dipswitch W1 on the 1800 system board. Use Figure 11 to locate W1.

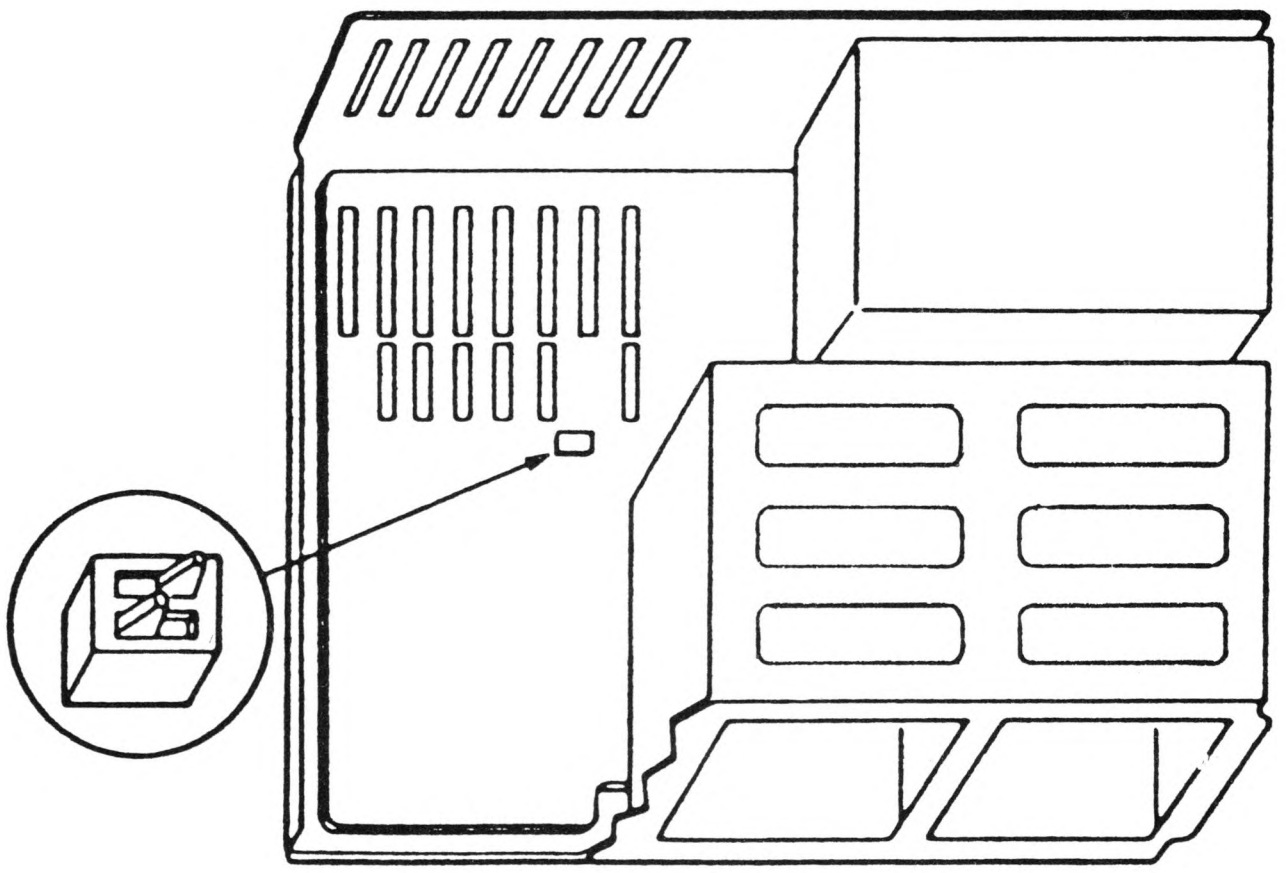


Figure 11: Dipswitch W1 in the 1800

Table 2 shows you the four valid configurations of system board RAM and the settings of dipswitch W1 that correspond to each.

TABLE 2

SYSTEM BOARD RAM CONFIGURATIONS

TOTAL RAM	CHIPS IN BANK 0	CHIPS IN BANK 1	SWITCH W1 SW1	SW2
256K	64K	64K	ON	ON
512K*	256K	EMPTY	ON	OFF
640K	256K	64K	OFF	ON
1 MB	256K	256K	OFF	OFF

*512K RAM is the standard configuration shipped with the 1800.

There is a total of 18 chips per bank. When you go shopping for chips, you should buy 18 chips (if you're adding one bank) or 36 chips (if you're pulling out the existing 256K chips and populating the board entirely with 64K chips).

Each chip has a Pin 1, which is marked with a notch or a dot. If you look closely at the green PC card, beneath each empty chip socket you will see a printed white outline of a notched chip in the proper orientation (Pin 1 toward the front of the chassis). You must install each chip in the correct orientation, with all its pins fully seated in the socket.

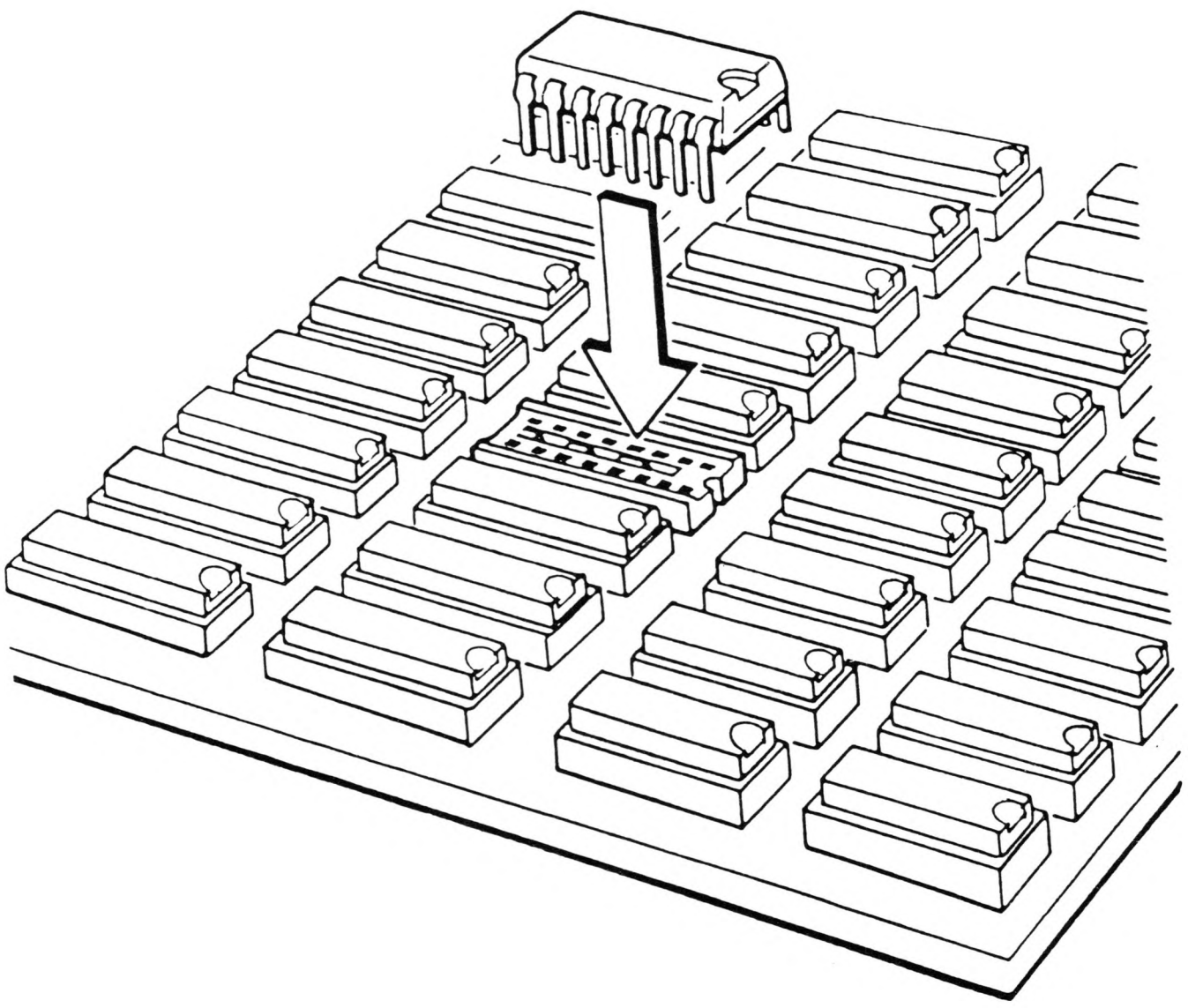


Figure 12: Installing RAM chips in the 1800

The pins that connect each chip to its socket are easily bent out of shape. No force is required to install RAM chips; if you have to press hard you are probably bending a pin.

If you make a mistake and have to remove a chip from a socket, insert the tip of a small flat-blade screwdriver under one end of the chip and twist gently. When the chip begins to loosen, move the screwdriver to the other end and loosen that side. Work gently back and forth until the chip is freed, then straighten the bent pin and start over.

DOS is able to support up to 640K of user-addressable **base** memory. If you add 256K RAM chips to the 1800, you will get a total of 1024K of memory. The extra 384K will become **extended** memory.

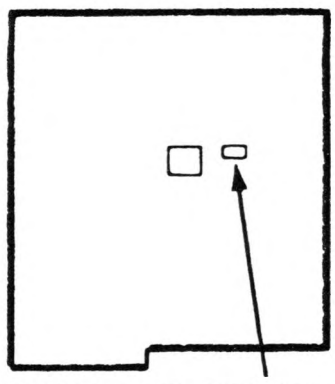
There is a program included on your DOS diskette (version 3.1 or later) that you can use to create a **RAM disk** in your extended memory. A RAM disk behaves like an extra floppy or hard disk drive installed in the system, but because there is actually no disk mechanically attached, access time is extremely fast. For more information on setting up a RAM disk, see your DOS manual.

2. EXCHANGING CRYSTALS

The 1800 comes with a 16 MHz crystal. Since computers generally run at half their crystal speed, the 1800 runs at 8 MHz unless you change its crystal.

The other crystal that the 1800 can accept is a 12 MHz. Switching in this crystal slows the system down to 6 MHz. The advantage is that while not all AT-compatible peripherals are able to run reliably at 8 MHz, all of them should run at 6 MHz.

The crystal looks like a little tin pellet on two wires. Its underside is stuck down to the system board by an adhesive pad.



LOCATION OF CRYSTAL Y-1

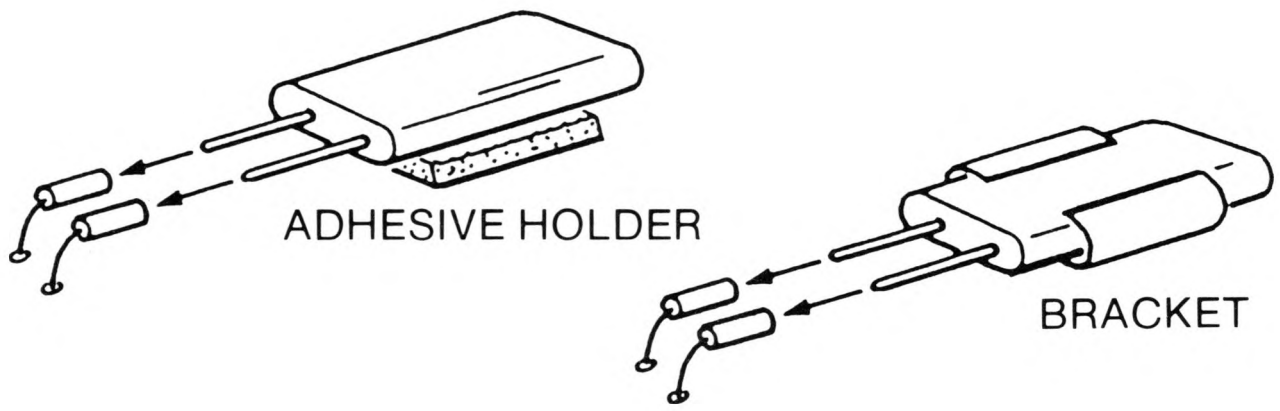


Figure 13: The 16MHz crystal in the 1800

To change crystals, simply pull the old crystal loose from the adhesive pad and slide it off the wires.

NOTE: Do not flex the wires back and forth too much or they will break from metal fatigue!

Install the new crystal on the wires, with the printing side face up, and stick it down on the adhesive pad. Your system is now set for 6 MHz operation.

3. THE 80287 MATH COPROCESSOR

The 1800 has a socket available for an 80287 math coprocessor chip. This chip is specialized to do floating-point arithmetic extremely fast. If you will be using your 1800 largely for math or science applications, you may want to invest in an 80287.

The 80287 is manufactured by Intel, and must be obtained from an authorized Intel representative.

80287 chips are available in two speeds: 8 MHz and 5 MHz. If you have left the original crystal in the 1800, you should get an 8 MHz 80287. If you switched to the slower 6 MHz crystal, get a 5 MHz 80287.

Use Figure 14 to locate the 80287 chip socket on the 1800 system board.

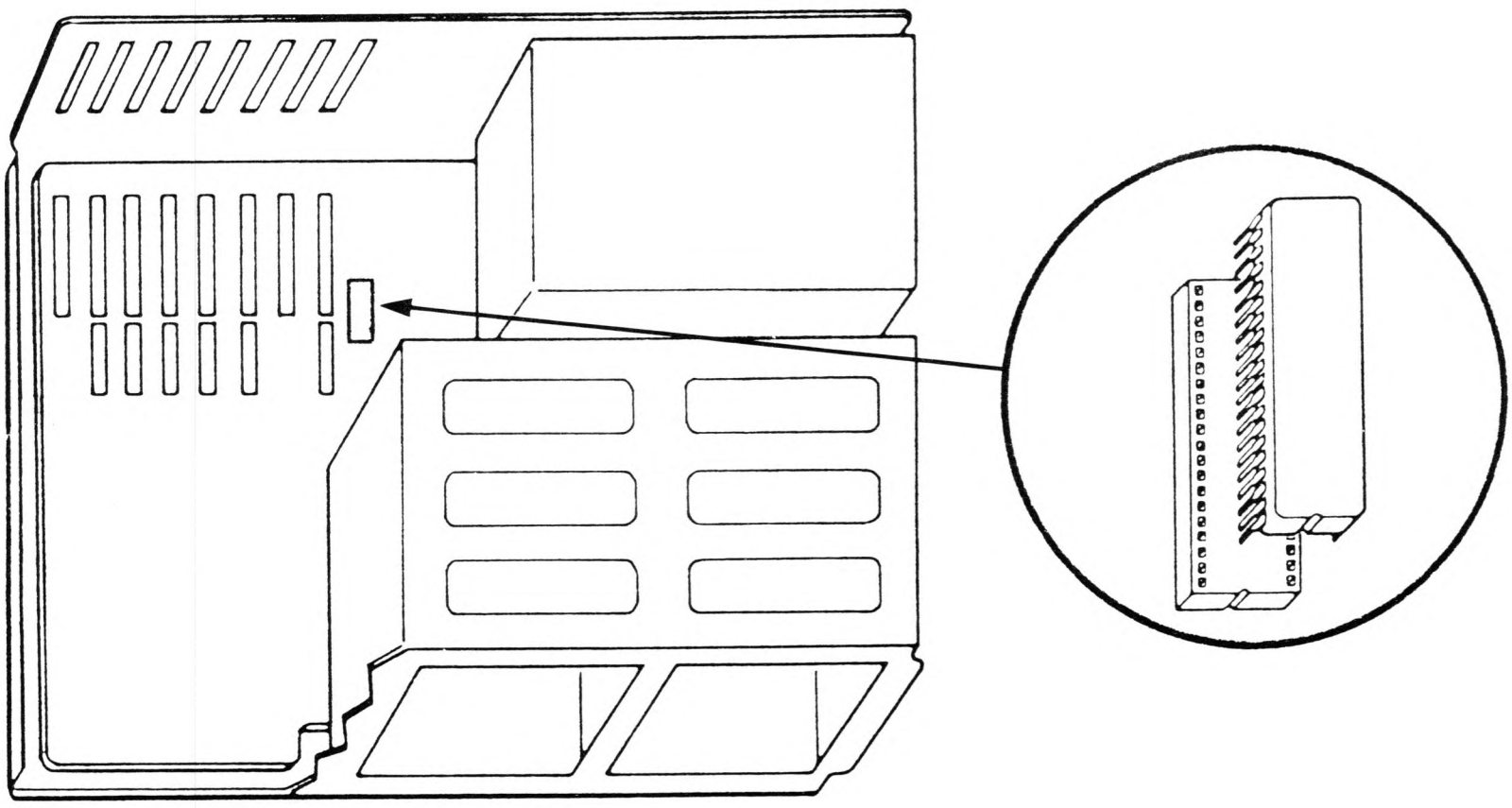


Figure 14: The 80287 socket in the 1800

The 80287 chip has a notch in one end. If you look closely at the system board under the 80287 socket, you will see a printed white outline of the notched chip in the correct orientation. The 80287 must not be installed backwards, or else it will be ruined when the system boots up.

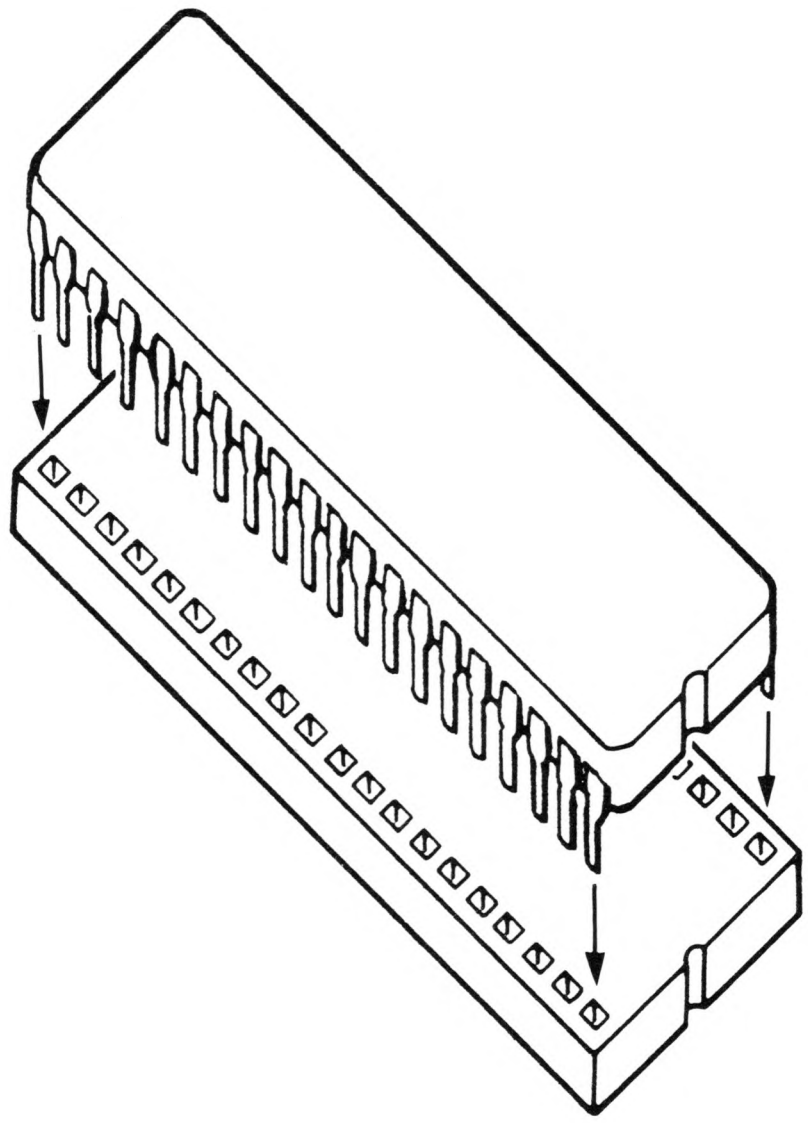


Figure 15: Installing the 80287

There are twenty pins along each side of the 80287. These pins must be perfectly aligned with the forty holes in the 80287 socket. When you install the 80287, check both ends carefully to be sure that no pins are hanging over the end of the socket.

Chapter III: Peripherals

NOTE: This Chapter is intended only to give you some basic information to assist your choice of peripherals for the 1800. Complete installation and operating instructions for every available product cannot possibly be included in this manual. It is essential that you read and refer to the operations manual that accompanies each peripheral you buy.

Locate your expansion slots on the left side of the chassis.

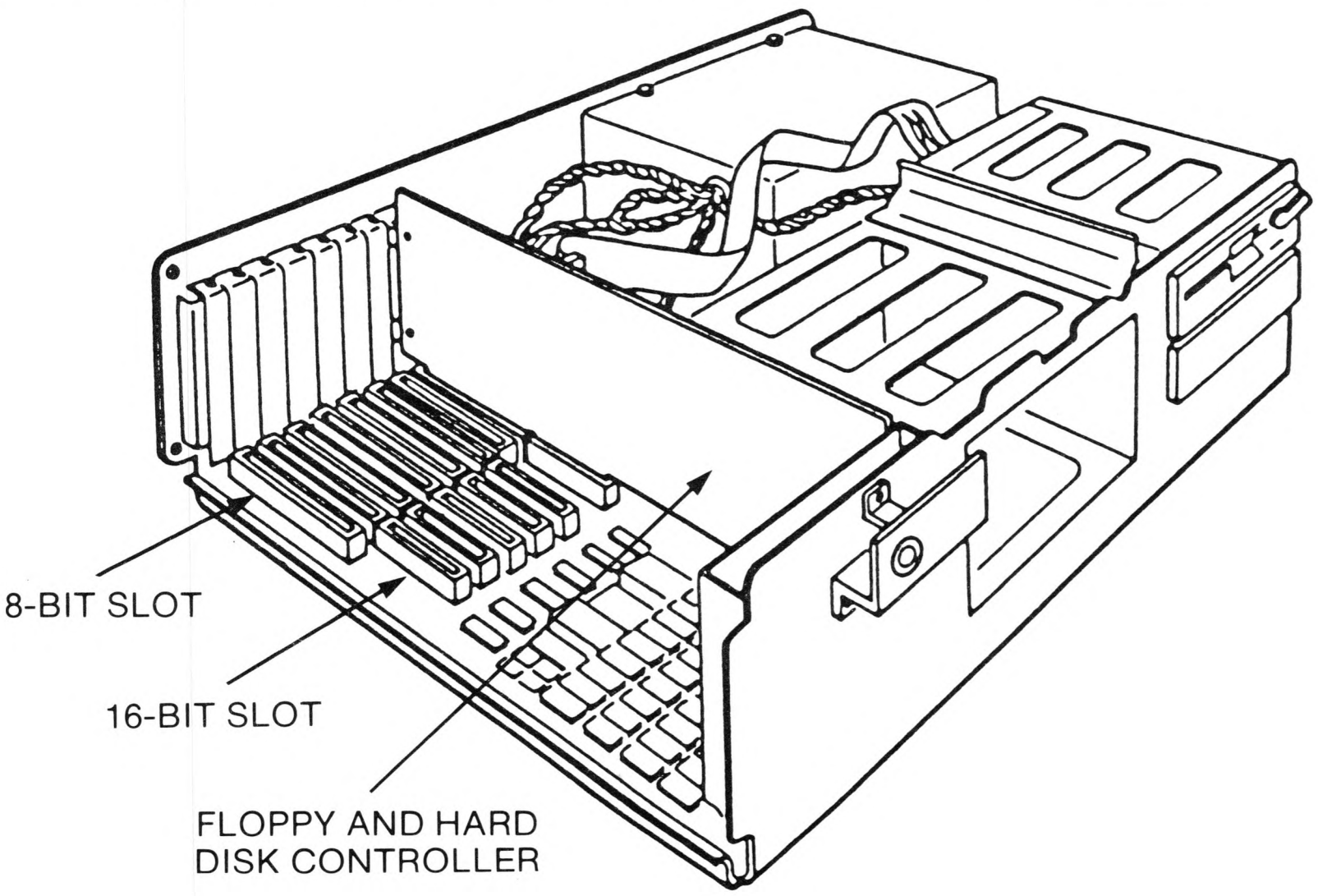


Figure 16: Expansion slots in the 1800

Note that six of your slots are sixteen-bit slots (two black bars end-to-end on the system board) and the other two are eight-bit slots (only one black bar). To install an expansion card with a sixteen-bit bus, you must use a sixteen-bit slot.

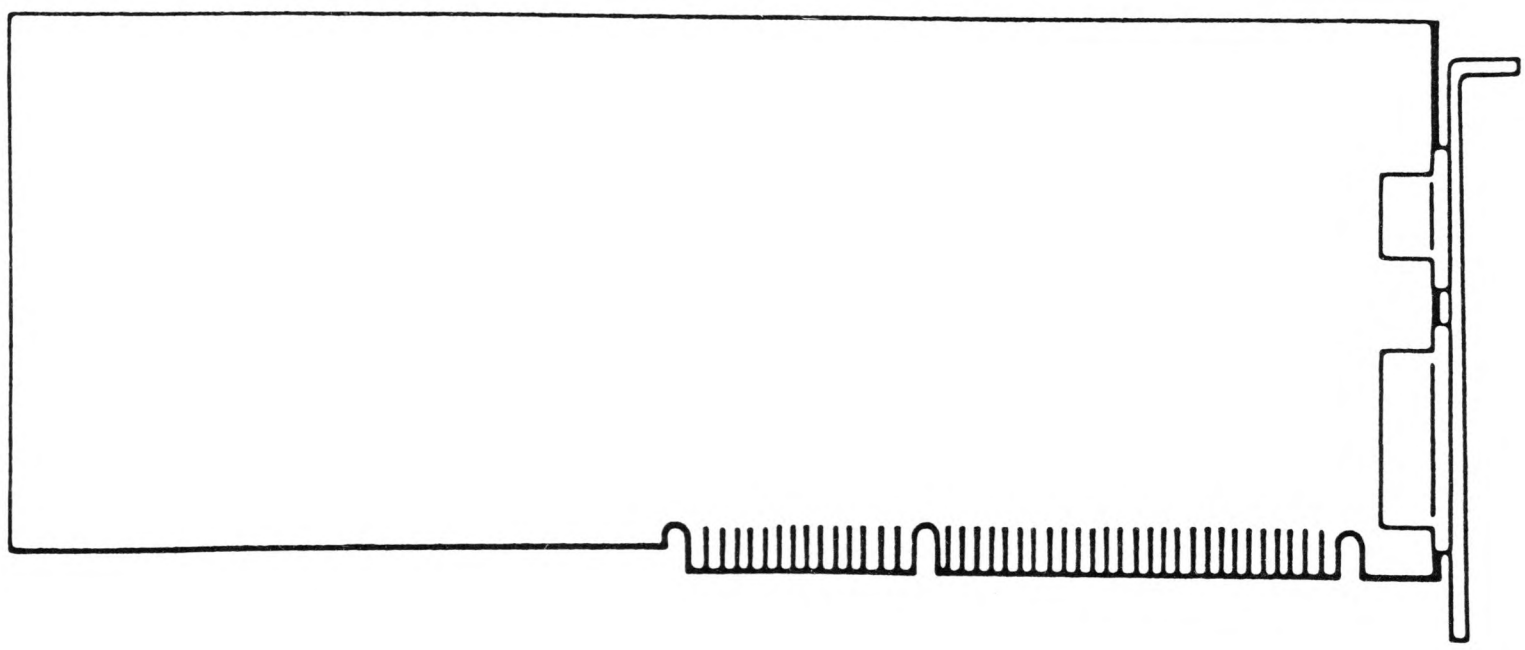


Figure 17: Card with a sixteen-bit bus

If you have a card with an eight-bit bus, install it in one of the 1800's two eight-bit slots. Some, but not all, eight-bit cards will run in a sixteen-bit slot.

Your primary source of information when installing peripherals in the 1800 is the operations manual that accompanies each product. However, there are a few general rules that apply:

- Always remember that circuit boards are very sensitive to static electricity. One shock can permanently damage their delicate electronics. You should rid your hands of static electricity by touching your system chassis *every time* before touching a circuit board.

- Don't eat, drink or smoke while you're working over an open computer.

- Mount your internal streaming tape drive in the half-height drive bank below the floppy drive. The plastic bezel that covers that drive space simply pops out.

- Remember to screw down the endplate brackets of your cards and keep slot covers in place over every unused slot. This minimizes the possibility of radio interference.

- Cards that attach to ribbon cables, such as drive controller cards, should as a rule be installed to the right of cards without cables. That way the cables are not in the way of other expansion slots.

- Be extremely careful not to let metal parts (such as screws or paper clips) get loose in your computer. If you drop a screw on the system board, you must find it and remove it before you apply power to your computer or you may cause a short-circuit.

The actual installation of cards in your expansion slots is very simple. Choose an empty slot, and remove the screw holding the slot cover to the back of the chassis.

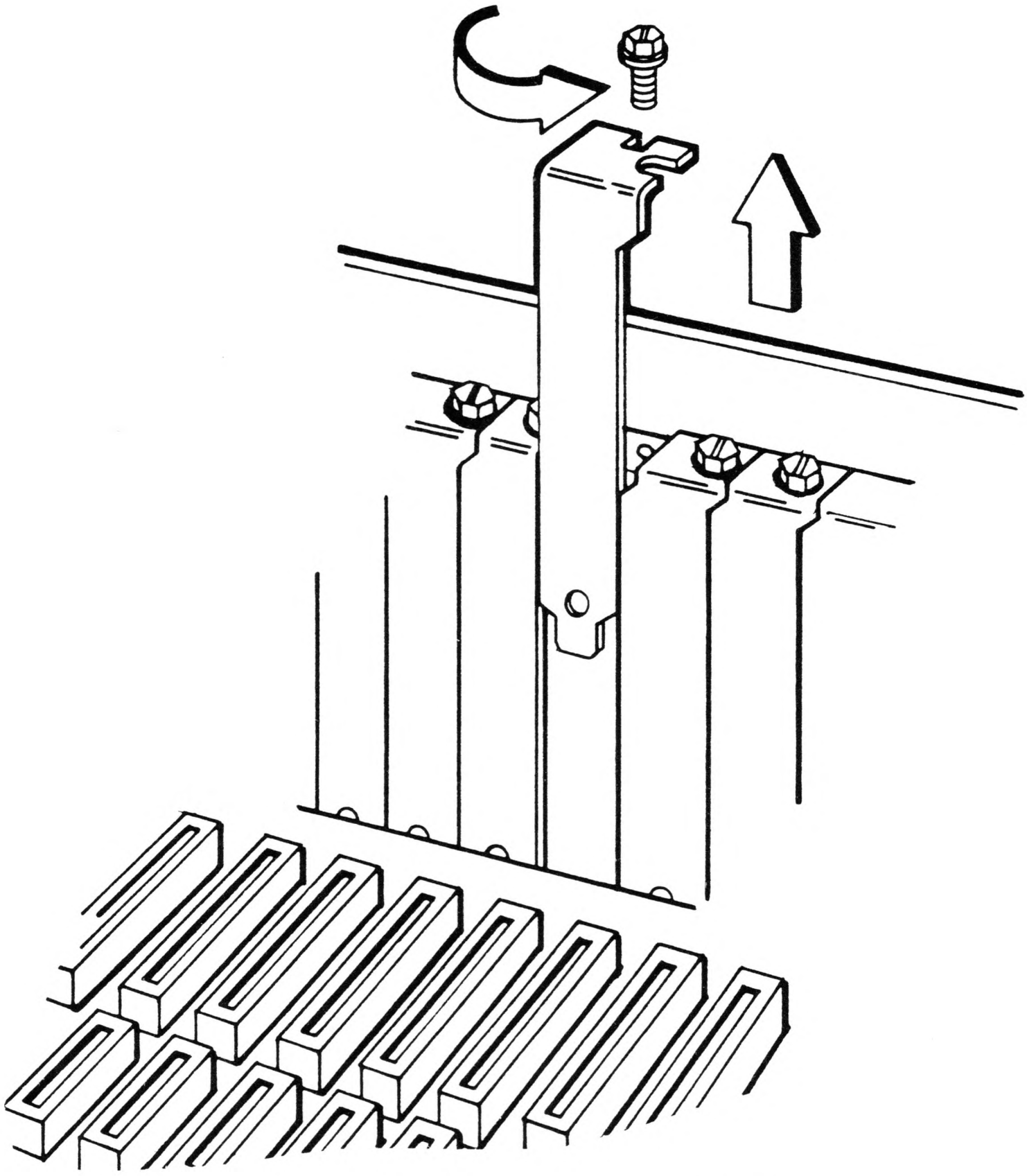


Figure 18: Removing Slot Cover

Slide the card into place, with its tab(s) meeting the grooves in the expansion slot. The endplate of the card should be in the same place that the slot cover just occupied. When the tab meets the groove, press carefully on the top edge of the card. The tab will snap into place.

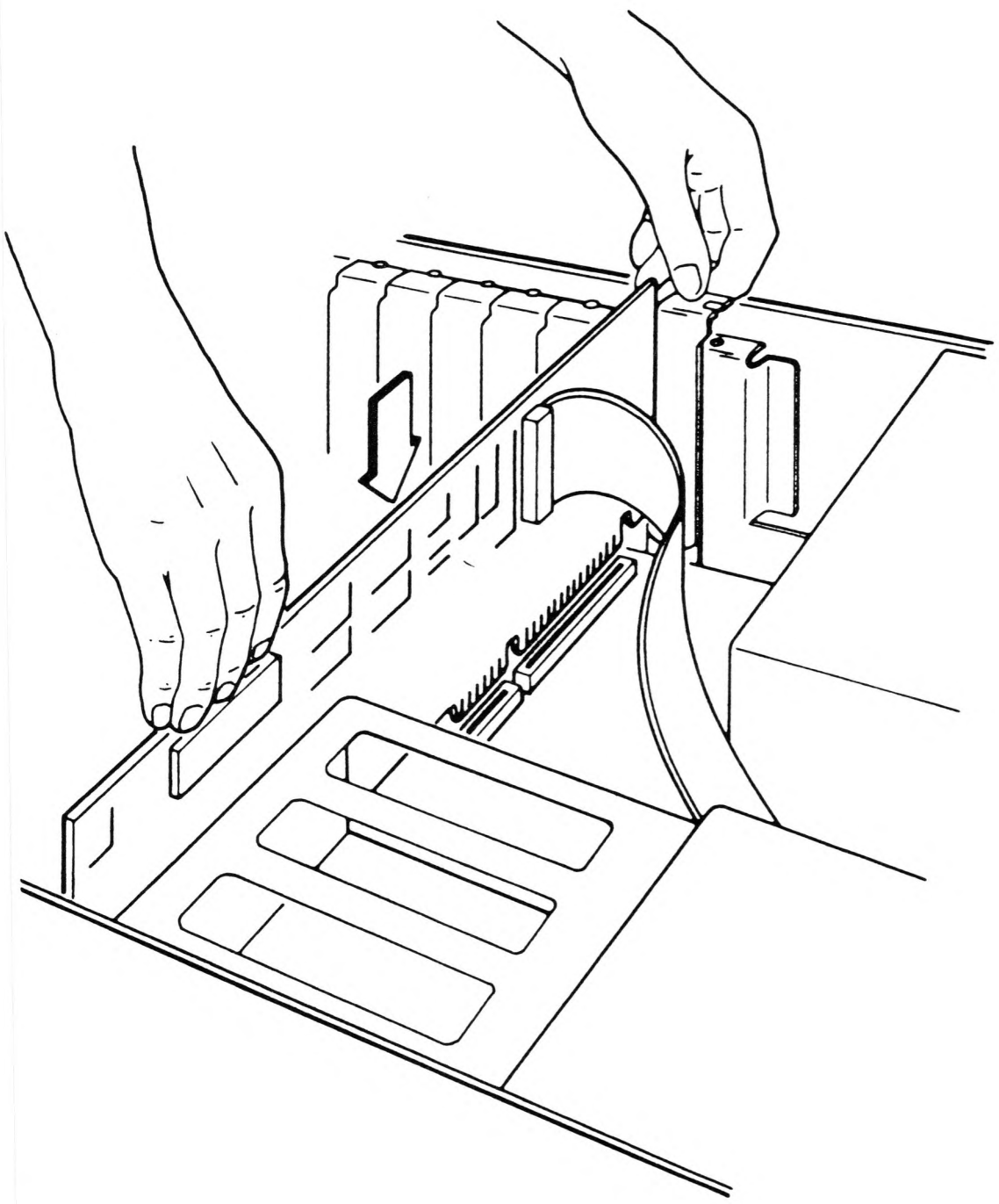


Figure 19: Installing a Card

Replace the slot cover screw, which will now secure the endplate bracket of the card to the back of the unit.

1. MONITOR

In order to see what your computer is doing, you need a monitor. There are three common types of monitors:

A. The monochrome monitor provides high-resolution text and graphics in one color only. It is optimized for word processing, spreadsheets, and other text applications which require the operator to look at the screen for a long time without eyestrain.

B. The color monitor provides lower resolution but more (usually 16) colors. It is optimized for games and other graphics applications.

C. The enhanced color monitor, a relatively recent innovation, provides the monochrome monitor's high resolution feature and the many colors (usually 16 out of a possible 64 at any one time) of a color monitor. This is the most expensive of the three.

There are many manufacturers providing each of these monitor types, in a wide range of quality and price, so you are well advised to spend a little time searching out the monitor that best matches your needs and your budget.

The monitor typically has two cables: one connects to the endplate of the display adapter and the other to a power supply. The 1800 has a connector for your monitor's power cable (next to the main system power connector on the back of the chassis), or you can plug some monitors directly into a wall outlet.

Most initial problems with a monitor can be solved by adjusting the horizontal and vertical hold knobs on the back and/or correcting the mode of the display adapter according to the display adapter manual.

2. DISPLAY ADAPTER

The display adapter is a card that goes inside your system and connects the monitor to the computer - it's like a monitor controller. Your display adapter type must be compatible with your monitor type. There are high-performance display adapters available that will run two or more monitors. Some of these offer features such as 132-column extended display, dual displays, and the ability to run color graphics software on a monochrome monitor. As with monitors, display adapters are available in a wide range of quality and price. Your best bet is to buy the monitor and adapter together to get a matched team that best suits your needs.

The display adapter installs in one of your free expansion slots. There are not many sixteen-bit display adapter cards on the market, so you should consider buying an eight-bit card that is physically compatible with a sixteen-bit slot. Also, many of the display adapters on the market are not designed to run reliably at 8 MHz, so if you expect to run at 8 MHz you should ask specifically about this when you buy your card.

The 1800 has a slide switch, called W3, on the system board. W3 determines whether the system boots up in color or monochrome mode.

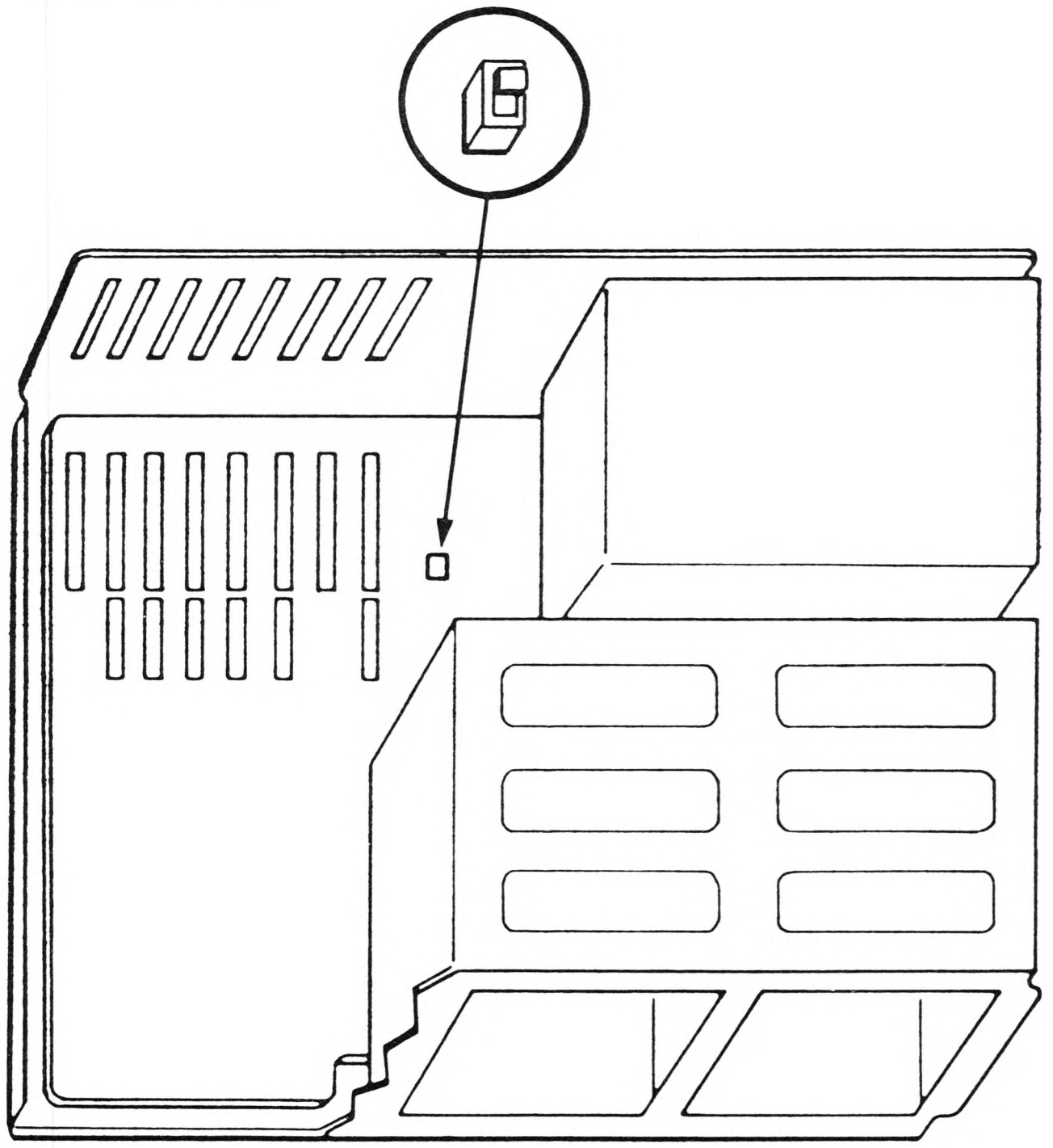


Figure 20: W3 on the 1800 System Board

If you have a monochrome display adapter, move this switch toward the back of the chassis. If you have a color adapter, move it toward the front. If you have an EGA (Enhanced Graphics Adapter) or a combination adapter, refer to its manual for the correct switch setting.

Often a display adapter will have several different display modes, which are set before boot-up by jumpers and/or dipswitches. Study the display adapter's manual carefully to be sure that you understand the modes and have the card set up for the mode you want before you install it, and be sure to get the correct setting for switch W3 on the 1800 system board. In some cases, you can damage your monitor by attaching it to a display adapter configured for the wrong mode.

3. PRINTER

There is an enormous variety of IBM-compatible printers on the market today. They fall into three categories: dot-matrix, which produce low-resolution text and graphics; daisy wheel, which produce better-quality text only, and laser-jets, which give by far the best resolution in text and graphics.

The dot matrix printers are relatively inexpensive and can do graphics as well as text printing. The quality of their output, however, is generally inadequate for business purposes.

Daisy-wheels are so called because they have all the characters of the keyboard on prongs arranged in a circle, like the petals of a daisy. A daisy-wheel printer produces output comparable to typewritten copy.

The laser jet printers are in a category by themselves, offering both high speed and extremely high resolution. Laser-jets to not actually strike the paper to form each character; instead they spray on the ink in an extremely precise pattern. They also tend to be quiet and easy to service, and can do all kinds of fancy fonts and page layouts. You pay for all these features: a laser printer typically costs several times the price of a dot-matrix printer.

Whatever printer you choose, you will need to connect it to your 1800 via a port. Laser jet printers that require an adapter card to be installed in the system will have their own dedicated ports on that adapter. If there is no special adapter card, then a parallel printer will need a parallel port and a serial printer will require a serial port. Parallel ports are available on some display adapters and almost all multifunction cards (see below), while serial ports typically come on multifunction cards or separate I/O (for input/output) cards. If you can get the port you need on another card, you save yourself a slot.

4. HARD DISK DRIVE

A hard disk drive lets you store large volumes of information for very fast access. The 1800 comes standard with a hard disk controller card, so there is no need to buy a controller with your hard disk.

You can buy internal and external hard disks, in sizes from 10 to over 100 megabytes. The controller that comes in the 1800 is able to interface up two two drives, whether internal, external, or one of each. The 1800's power supply is 192 watts, which is almost always adequate even for a fully stocked system, and has three extra power cables for connecting drives.

The red light on the front panel of the 1800 lets you know when your drive is in use (spinning).

If you install an internal half-height drive, remember *not* to install it underneath a floppy drive or tape drive. The hard disk drive must always be by itself or on top of the other drive in a bank.

There are two hard disk drive ribbon cables included with the 1800. The first is a 34-pin daisy chain cable that connects to one or two drives and transfers command signals between the controller card and the disk drive. If you install *one* drive, it should be connected to the *end* of the cable. If you install *two* drives, the drive connected in the middle of the cable is Fixed Disk 1 and the drive on the end is Fixed Disk 2.

The second cable is narrower (20 pins) and transfers your actual data between the drive and the controller card.

Refer to your hard disk manual for complete instructions on installing the drive.

After you install the drive you must run the SETUP utility provided with the 1800. This program will ask you for a drive type number for each hard disk. Locate the drive type of your disk(s) on Table 3 below.

TABLE 3

HARD DISK DRIVE TYPES

DRIVE TYPE	CAPACITY PER DRIVE	DRIVE NAME AND MODEL NUMBER
1	10 MB	COGITO CGF912; MMI M212 AND M312; SEAGATE ST412, ST212, ST112; RODIME RO202; TANDON TM252 AND TM502; FUJITSU M2233; SHUGART 712[1]; MINISCRIBE 2012 AND 3412; MICROSCIENCE 612
2	21 MB	TULIN TL226[1]; QUME R200[1]; SHUGART 724[1]; SEAGATE ST225, ST4026; FUJI FK302-26
3	31 MB	TULIN TL240[1]; QUME R300[1]; RODIME RO206
4	64 MB	ATASI 3080[1]
5	48 MB	
6	21 MB	MICROSCIENCE 725; TANDON 262

DRIVE TYPE	CAPACITY PER DRIVE	DRIVE NAME AND MODEL NUMBER
7	31 MB	QUANTUM Q540[1]
8	31 MB	SEAGATE ST4038
9	115 MB	MAXTOR XT-1140[1]
10	21 MB	MICROPOLIS 1302[1]; VERTEX V130[1,2]
11	36 MB	VERTEX V150[1,2]; SEAGATE ST4051
12	51 MB	VERTEX V170[1,2]
13	21 MB	SEAGATE ST425; MMI M225, M213; RODIME RO204; FUJITSU M2235
14	44 MB	
NO DRIVE TYPE		FUJI FK302-13; SEAGATE ST213

[1]Not all cylinders used

[2]The Vertex drives have 987 cylinders, so only 83% of the V130 and 87% of the V150 and V170 are used.

NOTE: The Fuji FK302-13 and the Seagate ST213 10MB drives have no drive type; they are not suitable for use with the 1800.

NOTE: Hard disk drives are often marketed under brand names different from the name of the manufacturer. If you cannot find the brand name of your disk drive on Table 3, examine the bare drive itself for an engraving or sticker bearing the name of the original drive manufacturer and the drive's model number.

Unlike diskettes, your hard disk requires two types of formatting: **physical formatting** and **logical formatting**. The physical format arranges the structure of the information on the disk media and marks the bad sectors on the hard disk. The logical format prepares the drive with DOS specific information.

Partitioning a hard disk drive divides the disk into sections called cylinders. When you partition, you can also devote part of the disk to non-DOS operating systems. This procedure must be done before the hard disk can be logically formatted.

The order of procedures to perform before you operate your hard disk is:

1. SETUP drive type identification

2. Physical format

3. Partitioning

4. Logical format with system transfer

These procedures must be done in this order

NOTE: Virtually all hard disks have bad tracks. Therefore, the disk is advertised at slightly less than its actual capacity. Even when all the bad tracks are discounted, the capacity you get from the disk will probably be slightly greater than advertised.

With every hard disk drive the manufacturer provides a list of the locations of the bad tracks. The list is a computer print-out which comes taped to the hard drive itself. This list references bad tracks by cylinder and head number. You will need the bad track list to format your hard disk drive. KEEP THIS LIST.

5. BACKUP

If you decide to add a hard disk drive, you are strongly encouraged to back up the data on it. Although hard disks are a reliable medium of data storage, they do eventually fail, and valuable information can also be deleted by operator error. Because the volume of information contained on a hard disk is so large, the failure of an unbacked-up disk can be disastrous.

There are several possible ways to back up a hard disk.

The first is to copy files onto floppy disks. However, floppy disk backup is so time-consuming and so tedious that users often lapse within the first few weeks, and when the hard disk fails they find themselves without backup. Also the quantity of floppy disks needed to back up a high-capacity hard disk quickly becomes unmanageable. At first glance, floppy disk backup appears to be very inexpensive, as it requires no special hardware and everyone already knows how to do it. But you should consider the cost of operator hours spent backing up on floppies, multiplied by the number of hours it takes to back up your whole hard disk, multiplied by the lifespan of your 1800 (plus the cost of the diskettes themselves) before you settle on this method of backup.

The other popular method of hard disk backup is a tape drive. There are two broad categories of tape drives: floppy tape and streaming tape. Of the two, floppy tape has the advantage of running directly from the floppy disk controller, so it doesn't take up an extra expansion slot.

Streaming tape has the advantages of being very fast, standardized, and reliable. You can even get a streaming tape drive that activates itself automatically at a specified time of day, freeing the operator from remembering backup at all. Because streaming tape is so easy to use, people actually do perform backups regularly, adding further to the reliability of this backup method. There are industry-wide QIC (for quarter-inch cartridge) standards that allow tapes to be interchanged among drives, which is mandatory for any sort of archival storage. The disadvantage of streaming tape is its cost, which may exceed the cost of the disk drive itself, but this investment should be weighed against the expense of re-generating lost data after a disk failure, not against the cost of replacing just hardware. The high price can be further eased by getting an external tape drive, which can be shared among several systems.

When you buy a tape drive, ask about the tape software that comes with it. Speed and ease of use are critical factors in the value of a tape subsystem, and these both depend on the quality of the tape software.

The one backup method that you should *not* consider is a second hard disk used for backup. This is extremely unreliable because the factor that causes your first disk to fail (such as an unexpected jolt to the system chassis) is likely to take out your backup disk at the same time.

If you decide to rely on floppy disk backup, you do not need to add any special equipment to your 1800. Just lay in a large supply of high-capacity (1.2 megabyte) floppy disks.

If you go with an external tape drive, you will need to install a controller card in each system that will use the drive. As with all cards you purchase for the 1800, consider the questions of 16-bit bus compatibility and 8 MHz operation.

If you buy an internal tape drive, make it a half-height drive only and install it under the floppy drive in your right drive bank. The plastic bezel covering that opening just pops out. Then install its controller card in the suitable slot that is furthest to the right, since there will be a ribbon cable connected from that card to the tape drive. Use one of the extra power cables provided in the 1800 to power the tape drive. Refer to your manual for detailed instructions on operating your tape drive.

6.MEMORY, I/O AND MULTIFUNCTION CARDS

The 1800 is capable of holding a maximum of 16 megabytes of memory. You can buy add-in memory cards which occupy the expansion slots of the 1800 to upgrade your memory to this limit.

If you want to connect your 1800 to a printer, a modem, or another external device, you will need a serial or parallel port (depending on the device) to accomplish this. These ports also come on add-in cards.

Since most people who own computers are interested in both of these options, and since the number of expansion slots inside each computer is limited, some manufacturers offer multifunction cards, which combine additional memory with serial and/or parallel ports, and often even more features, on a single card. As with all add-in cards that you buy for the 1800, ask about sixteen-bit buses and whether the product was designed to run at 8 MHz speed before you buy.

These are not the only possible peripherals you can get for your 1800. For instance, you can also add an internal or external modem, a mouse, a light pen, a second floppy disk drive, or any number of others. If you want more peripherals than your 1800 can hold, you can buy an expansion chassis to hold the overflow.

NOTE: Do not apply power to your 1800 until you have finished installing your peripherals.

Chapter IV: Keyboard

Features

- 84 keys
- 8 keys rollover
- Serial data output
- Low-profile enclosure
- 7^0 - 13^0 adjustable position
- Default auto repeat at 10 characters per second
- Cable: 3.6 meter, 5 wires
- Power dissipation: DC5V 240mA
- Connecting: 5-pin DIN connector
- Weight: 4.2 lbs (1.9 kgs)
- Dimensions: 19.96" x 7.6" x 1.46"

The keyboard is divided into three sections: the typewriter key area, the function keys, and the numeric keyboard.

You can adjust the angle of the keyboard by pushing in and then turning the small round lever on either side of the keyboard.

The keys are typematic. This means that, as long as you hold down a key, it will continue to repeat.

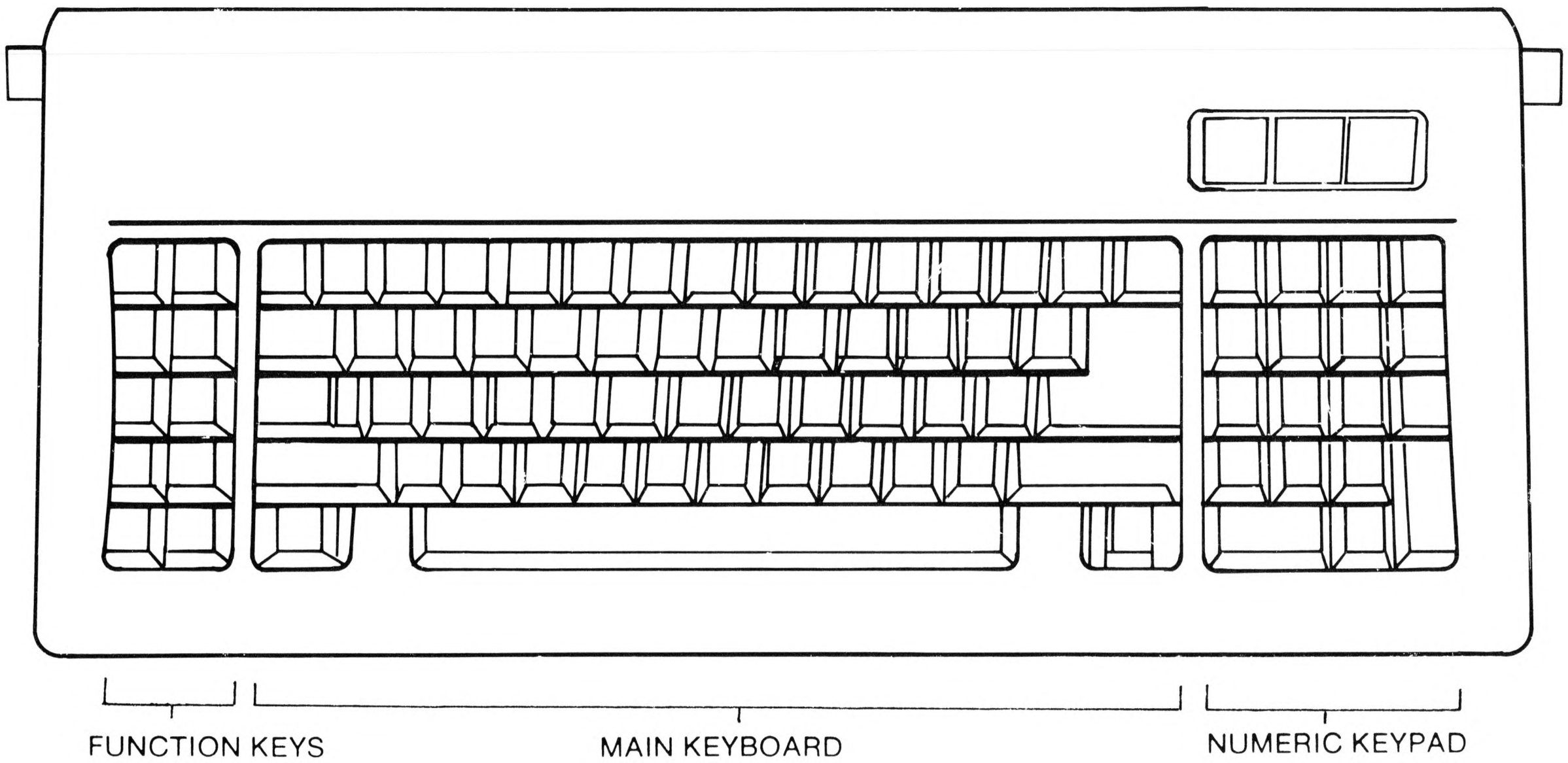


Figure 21: The 1800 keyboard

1. THE FUNCTION KEYS

The function keys, which are located at the left of the keyboard, enable you to activate a command using only a single key. When you run the IBM BASIC or BASICA programming languages, each key replaces the following function:

F1 : LIST B	F6 : "LPT 1
F2 : RUN -	F7 : TRON -
F3 : LOAD"	F8 : TROFF -
F4 : SAVE"	F9 : KEY B
F5 : CONT	F10 : SCREEN 0,0,0

with B = to a blank space
and - = to the return key.

If, for example, you wanted LOAD"FILE 1" to appear on the screen, then you would only need to push the F3 key and type in FILE 1". LOAD"FILE 1" would appear on the screen

2. THE NUMERIC KEYPAD

The numeric keys are located at the right side of the keyboard. When used with the program editor, these keys enable you to move the cursor up, down right and left. You can also use the Num Lock key to set the numeric keypad so that it works more like a calculator keypad. Pressing the Num Lock key shifts the numeric keypad into its own upper-shift mode, so that you get the numbers 0 through 9 and the decimal point, as indicated on the keycaps. Pressing Num Lock again will return the key pad to its normal cursor control mode. As with Caps lock, you can temporarily reverse the Num Lock state by pressing one of the Shift Keys. The NUM LOCK's LED indicator will light up when the keyboard is in the numeric keyboard state.

Cursor Up

Moves the cursor one position up.

Cursor Down

Moves the cursor one position down.

Cursor Left

Moves the cursor one position left. If the cursor advances beyond the left edge of the screen, the cursor will move to the right side of the screen on the preceding line.

Cursor Right

Moves the cursor one position right. If the cursor advances beyond the right edge of the screen, the cursor will move to the left side of the screen on the next line down.

Home

Moves the cursor to the upper left-hand corner of the screen. When the CTRL and HOME keys are pressed simultaneously, the screen is cleared and the cursor is positioned in the upper left-hand corner of the screen.

End

Moves the cursor to the end of the logical line. When the CTRL and END keys are pressed simultaneously, the data from the current cursor position to the end of the logical line is erased. All physical screen lines are erased until the terminating Enter is found.

PgUp

When the CTRL and PGUP keys are pressed simultaneously, the cursor will move to the top of the document.

PgDn

Moves the cursor down 25 lines. When the CTRL and PGDN keys are pressed simultaneously, all data from the cursor position to the EOS (End of Screen) will be deleted.

Ins

Turns on the insert mode. If the insert mode is off, pressing this key will turn it on. If the insert mode is already on, pressing this key will turn it off.

When you are in the insert mode, data typed in will be inserted (vs. overwriting) the text which already exists. Line folding will occur (as characters are moved off of the left hand side of the screen , they will wrap around and form a new line on the line below.

When the insert mode is off, any characters typed in will overwrite the text which is already in existence.

You can also turn off the insert mode by pressing any of the cursor movements keys or the <- key.

Del

Deletes the character at the current cursor position. All characters to the right of the deleted character move one position left to fill in the empty space. Line folding occurs.

3. THE MAIN KEYBOARD

The typewriter area of the keyboard behaves much like a standard typewriter. Capital letters and the special characters shown above the numbers on the number keys are displayed by holding down either of the SHIFT keys and pressing the desired key. The functions of some of the special keys are described below.

Caps Lock

The CAPS LOCK key is similar to the shift lock key on a typewriter, but it will only give you capital letters and not the uppershift characters on the numeric or other keys. After this key is pushed, you will continue to get capital letters until the CAPS LOCK key is again pushed. To get lower case letters while the CAPS LOCK is activated, push the SHIFT key while pushing the letter desired. The LED indicator will light when the CAPS LOCK is on.

Alt

The Alt key enables easy entry of BASIC statement keywords. This key allows you to type an entire BASIC keyword with a single stroke.

The BASIC keyword is typed when the Alt key and one of the alphabetic keys, A - Z, are simultaneously held down. Keywords associated with each letter are summarized below. Letters not having reserved words are noted by 'NO WORD'.

A	AUTO	M	MOTOR
B	BSAVE	N	NEXT
C	COLOR	O	OPEN
D	DELETE	P	PRINT
E	ELSE	Q	NO WORD
F	FOR	R	RUN
G	GOTO	S	SCREEN
H	HEXS	T	THEN
I	INPUT	U	USING
J	NO WORD	V	VAL
K	KEY	W	WIDTH
L	LOCATE	X	XOR

Shift

Capital letters and the special characters shown above the numbers are displayed by holding down either of the SHIFT keys and pressing the desired key.

Ctrl

The Ctrl key is always used in conjunction with another key to perform a command or function other than that normally performed with the second key. Below are examples of some of these functions.

Ctrl-G

Bell. When these two keys are pushed, the speaker beeps.

Ctrl-Scroll Lock

Break. This stops your program while it is running.

Ctrl-Num Lock

Pause. This temporarily stops your program; press any key to continue.

Ctrl- ->

Next word. This moves the cursor right to the next word on the line.

Ctrl- <-

Previous word. Moves the cursor left to the previous word on the line.

Ctrl-Home

Clear screen. This removes all information on the screen and moves the cursor to the upper left corner.

Ctrl-Alt-Del

System reset. Holding both the Ctrl and the Alt keys simultaneously and then pressing the Del key reloads the system or program diskette. (An error message will appear if a data diskette is loaded.)

Alt-Esc

When the computer is turned on, a buzzer will automatically sound whenever a key is pressed. If you do not wish this buzzer to sound, press down these keys. To reactivate the buzzer, push these keys down again.

Tab

Moves the cursor to the next tab stop. Tabs stops occur every eight character positions.

When the insert mode is off, pressing the Tab key moves the cursor over characters until it reaches the next tab stop.

When the insert mode is on, pressing the Tab key inserts blank spaces from the current cursor position to the next tab stop. Lining folding will occur.

Esc

When pressed, the entire logical line in which the cursor is positioned will be deleted. The line is not passed to BASIC for processing. If it is a program line, the line is not erased from the program in memory.

Backspace

The <- key not only backspaces, but it also erases the letters that it is passing over. All characters to the right of the deleted character will move left one position to fill the deleted space. Subsequent characters and lines within the current logical line will move up as with the Del key.

If you wish to move to the left and not erase the letters which you are passing, use the Cursor Left Key in the Numeric pad section of the keyboard.

Enter <-

This is the Carriage Return or Enter key.

PrtSc / *

Below the Enter key is the PrtSc * key. PrtSc stands for 'Print Screen'. When the keyboard is in lowershift, pressing this key causes the asterisk to be typed. In uppershift, this is a special key that causes a copy of what is on the screen to be printed on the printer (LPT 1:). So, if you ever need a hard (or printed) copy of what is currently being displayed, press the PrtSc key and SHIFT simultaneously. (Note: characters which are unrecognizable by the printer are printed as blank spaces.)

Scroll Lock

When the Scroll Lock and Ctrl keys are pushed simultaneously, the program execution at the BASIC instruction level is interrupted and returns to the BASIC command level. It is also used to exit the AUTO line numbering mode.

Chapter V: Trouble Shooting

If your 1800 does not work the first time you start it up, go through this checklist. 90% of the failures that happen to professionals and brand new users alike will be solved before you get to the end.

- Check that the main power cord is fully plugged in, one end to the 1800 chassis, the other end to a grounded (3-prong) wall outlet.

- Check that the monitor's power cord is connected to the 1800 chassis and its display cord to the endplate of your display adapter.

- Check that the monitor is turned ON.

- Turn up the monitor's brightness control knob.

- Check that the five-pin keyboard cable is plugged in securely to the system unit. Note that the plug must be in the correct orientation (there is a bump on the plug that should be on top) to fit completely into its socket.

- Check that there is a DOS diskette in the floppy drive, and the drive door is closed (lever pointing down).

- When booting from the hard disk drive, make sure that there is *not* a diskette in drive A and the drive door is open.

1. ERROR CODES

If you see an error code on the screen, look it up on this list and follow the accompanying instructions. If the instructions fail to clear up the problem and the error pertains to a peripheral product in the system (i.e. a monochrome display adapter), re-read the manual that accompanies that product. If you cannot isolate and correct the problem, then professional service is required.

Always write down the exact number of the error code that you receive. In the event that the unit requires professional repair, give this number to the repair person.

NOTE: Any error code ending in 00 means no error, test completed successfully. If you see one of these, ignore it.

ERROR CODE	EXPLANATION AND ACTION
101	System board error. Requires professional repair.

201 Memory error. Use Figure 22 to locate dipswitch W1 on the system board.

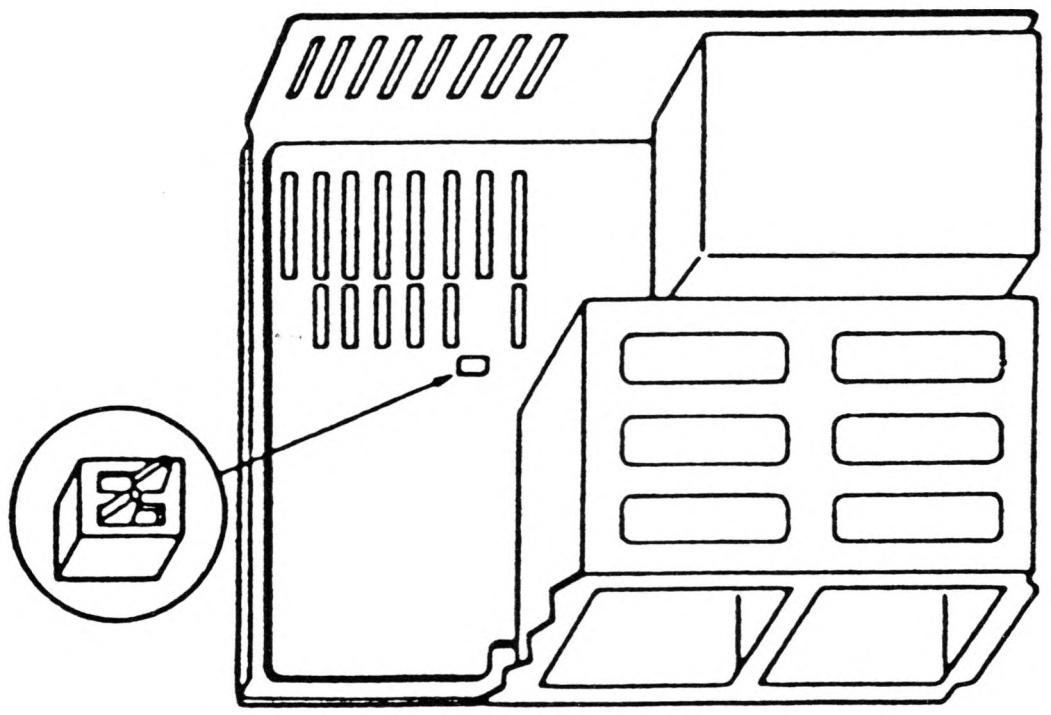


Figure 22: W1 in the 1800

Check the system board dipswitch W1 against Table 4 and correct the settings if necessary.

TABLE 4

SYSTEM BOARD RAM CONFIGURATIONS

TOTAL RAM	CHIPS IN BANK 0	CHIPS IN BANK 1	SWITCH W1 SW1	SW2
256K	64K	64K	ON	ON
512K*	256K	EMPTY	ON	OFF
640K	256K	64K	OFF	ON
1 MB	256K	256K	OFF	OFF

One of your RAM chips may be bad or missing or incorrectly installed. If you cannot locate an incorrectly installed chip, bring in the unit for professional repair.

301 Keyboard error. The most common error code of all. Check that the five-pin keyboard cable is plugged in securely to the system unit. Note that the plug must be in the correct orientation (there is a bump on the plug that should be on top) for the cable to fit completely into its socket.

401 Color or monochrome adapter error. Check that the monitor is securely plugged in both to an electrical source and to the endplate of your display adapter. Read your adapter manual, and verify that any jumpers and/or switches on the adapter are set correctly. If you still get the error code, bring in the monitor for professional repair.

501 Color adapter error. Same procedure as above, but for color monitor only.

601, 602 Floppy drive or controller error. Generally, the cables between the floppy drive and its controller are disconnected or connected backwards. Verify that the cables between the floppy and hard disk controller, and the floppy drive, are connected as illustrated below.

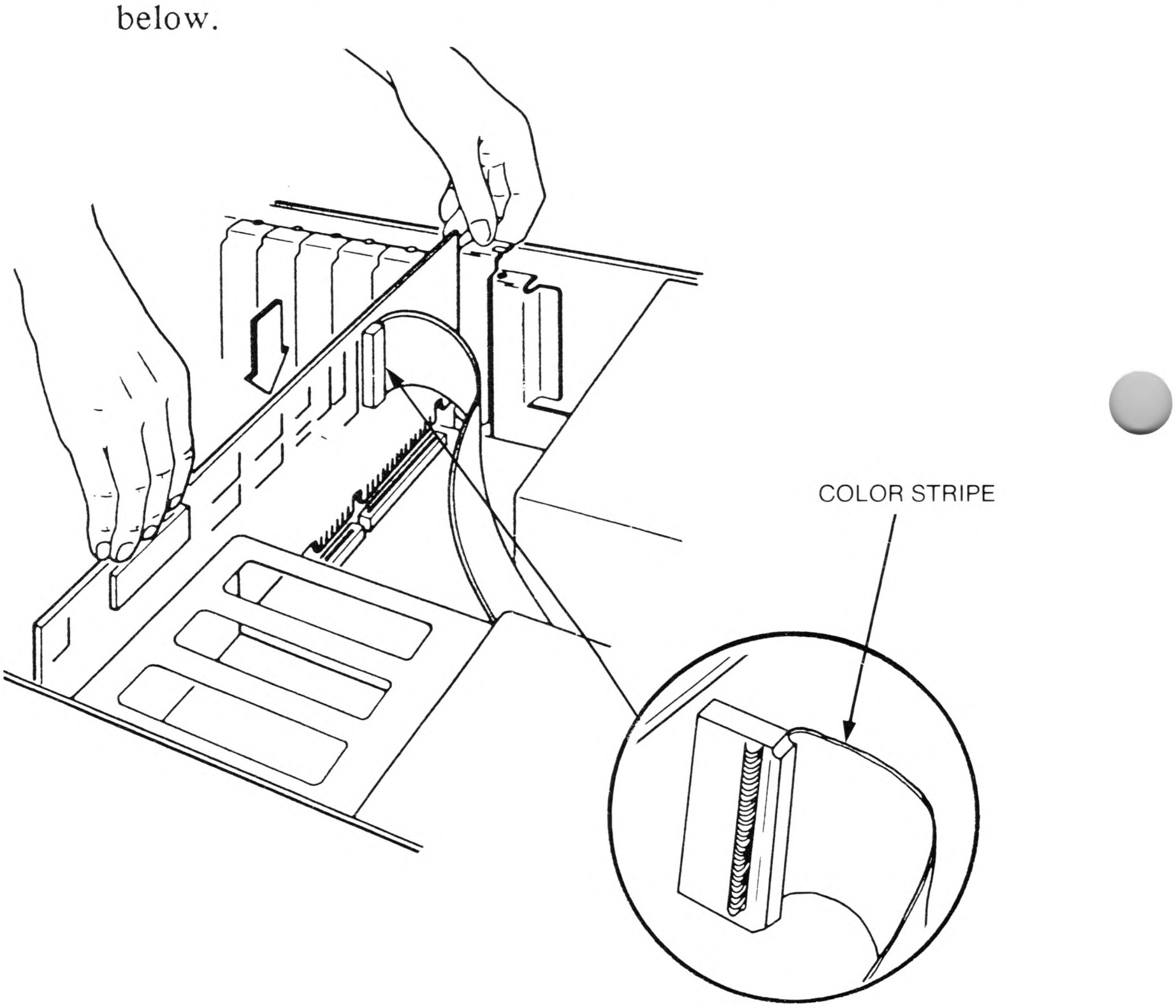


Figure 23: Correct Connection of Cables to the Floppy Drive Controller

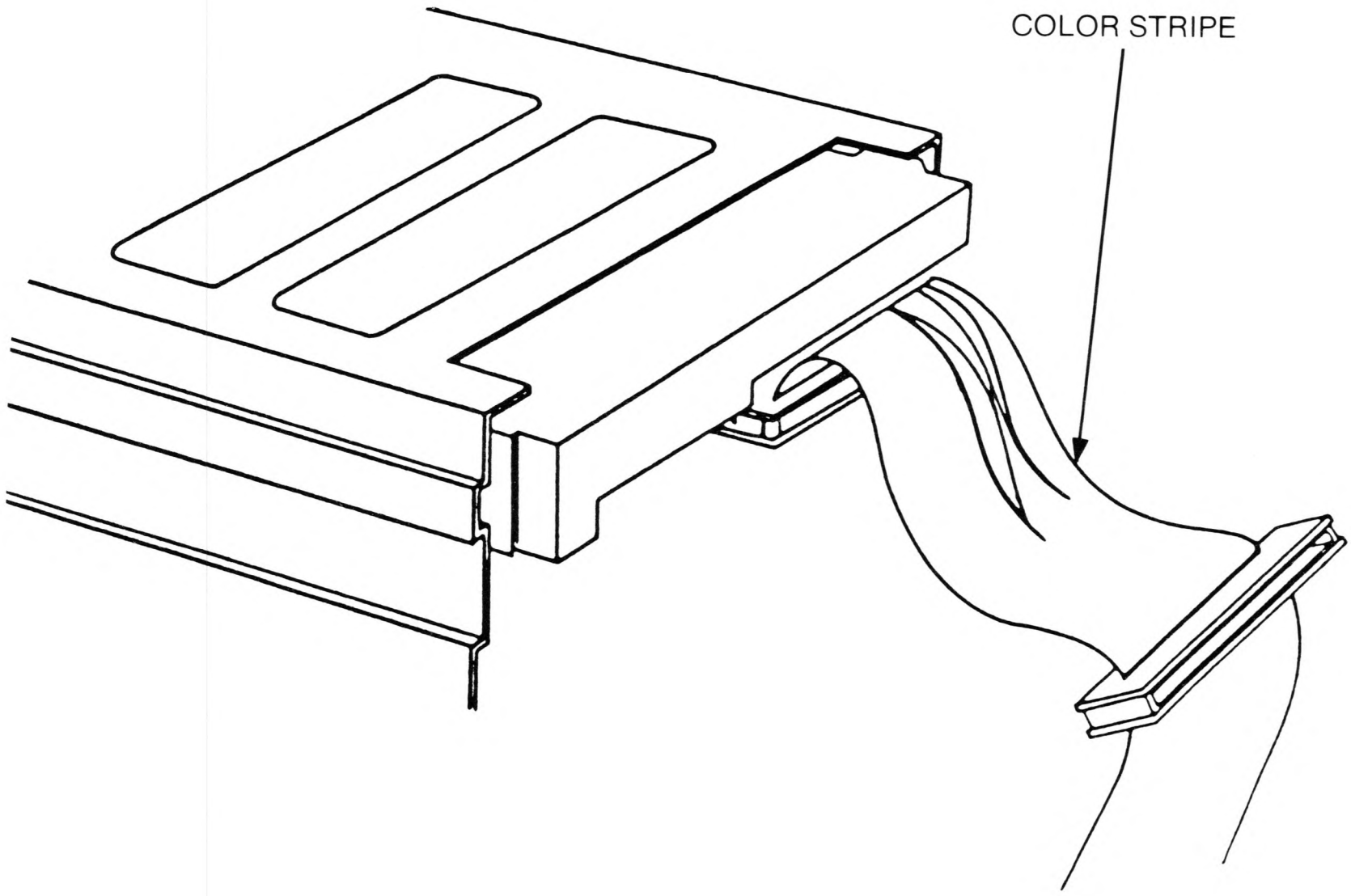


Figure 24: Correct Connection of Cables to Floppy Drive

Note: There is an extra cable included for a hard disk. If you have not installed a hard disk, disregard the extra cable.

701 Math coprocessor error. Get a new 80287 math coprocessor. Either the 80287 you installed was defective, or it was installed backwards, in which case it is now destroyed.

901 Printer adapter error. Check that the printer cable is correctly attached to the adapter. If you have two or more printer adapters in place (i.e. one parallel port on a display adapter and one on a multifunction card) check that they are not configured for the same LPT.

1101 Asynchronous communications adapter (serial port)
1201 failure. I/O adapter cards, multifunction cards, and some display adapters may include serial ports. Identify the serial port(s) in your system and check the cabling attached to each. If possible, check for COM port conflicts (study manual that accompanies each serial port adapter to determine: 1. factory default COM port setting, 2. whether that COM port setting can be reconfigured or, if not needed, disabled, and 3. proper procedure for reconfiguring/disabling that COM port). Reconfigure or disable conflicting serial ports. If possible, remove each serial port adapter in turn and re-boot. If you don't get the error code in the absence of one of your serial port adapter(s), bring that adapter for professional service.

1301 Game port adapter error. Check cabling. If you have more than one game control device (i.e. game paddle and joystick) test each one in turn.

1401 Graphics printer error. Check cabling of printer to 1800 and to electrical supply. Re-read printer manual.

1501 SDLC (Synchronous Data Link Control) error. Check attachment of modem to system. Re-read modem manual. Re-boot system without modem installed; if error does not repeat, get professional service.

1701 Fixed disk error. This error code will occur, and should be ignored, the first time you boot up with a hard disk in place. This is because the disk is not yet formatted. If the error persists after the disk has been formatted, repeat the format procedure. This may take up to 40 minutes for a 20MB drive, so do not interrupt the procedure before it is complete. Refer to your hard disk manual for more information.

IBM Advanced Diagnostics is a very useful program for troubleshooting not only the IBM AT but also compatibles such as the 1800. However, because the IBM AT keyboard and the 1800 keyboard are not identical in their electronics, this program may sometimes generate a keyboard error where none exists. If you use IBM Advanced Diagnostics, be prepared for this possibility.

Chapter VI: For New Users

Learning to use a computer for the first time is like learning to drive a car: at first it seems very intimidating and complicated. Then you get your arms around a few basic concepts of how the thing works, you master a couple of tricks specific to operating your machine, and pretty soon it seems like second nature.

This Chapter is written specifically for the person who has never used a personal computer. If you fit this description, it might be worth your while to read the whole chapter once, just to get a feel for how the system works.

The format is question-and-answer to allow you to scan quickly for the information you want.

Before you start to read this Chapter, take the cover off your system chassis. This will make it easy for you to identify the 1800's internal parts as they are explained, and you'll understand the descriptions better when you can see the part in question. If you decide it's all over your head and you want nothing more to do with the insides of your computer, you can always just slide the cover right back on.

There are five cover mounting screws that hold the cover on the 1800.

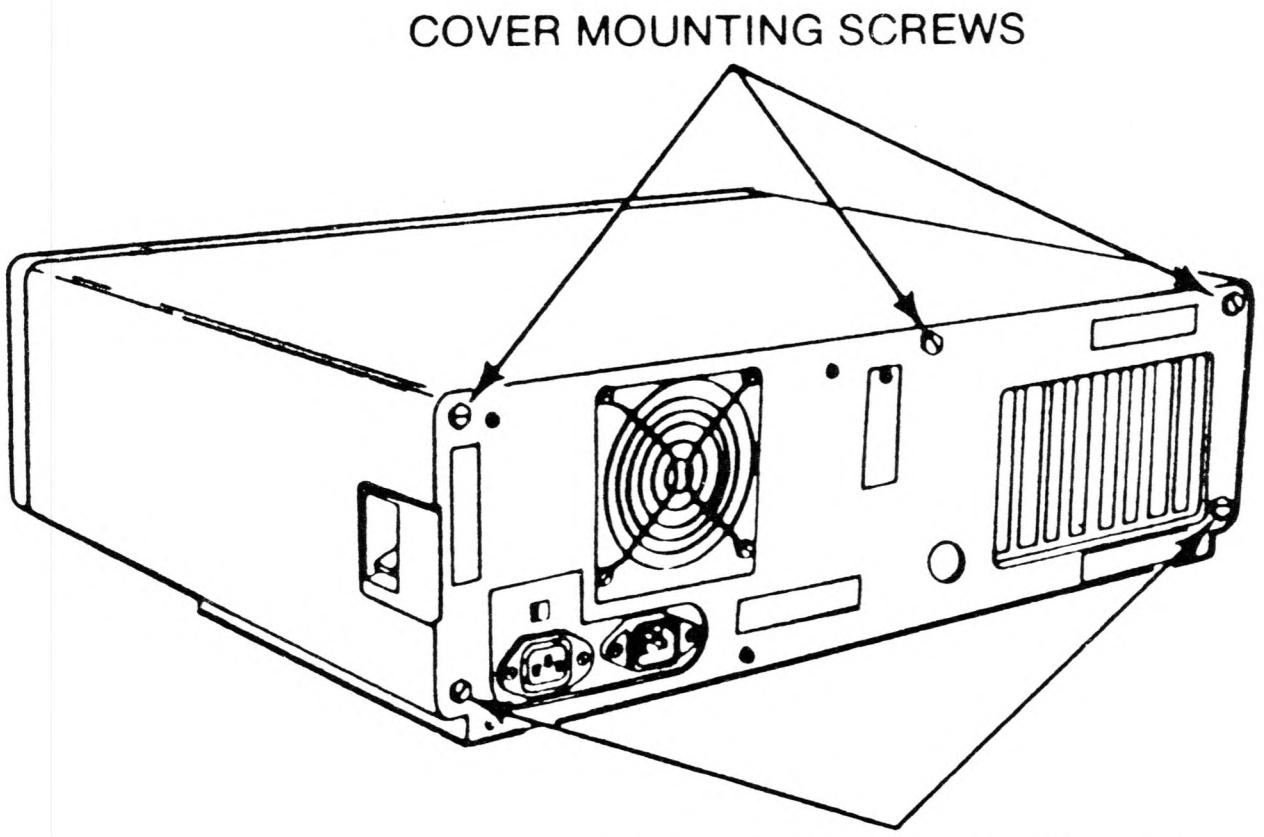


Figure 25: Cover mounting screws on the 1800

Carefully identify and remove all five screws. Then grasp the sides of the chassis with both hands and slide it gently forward and off.

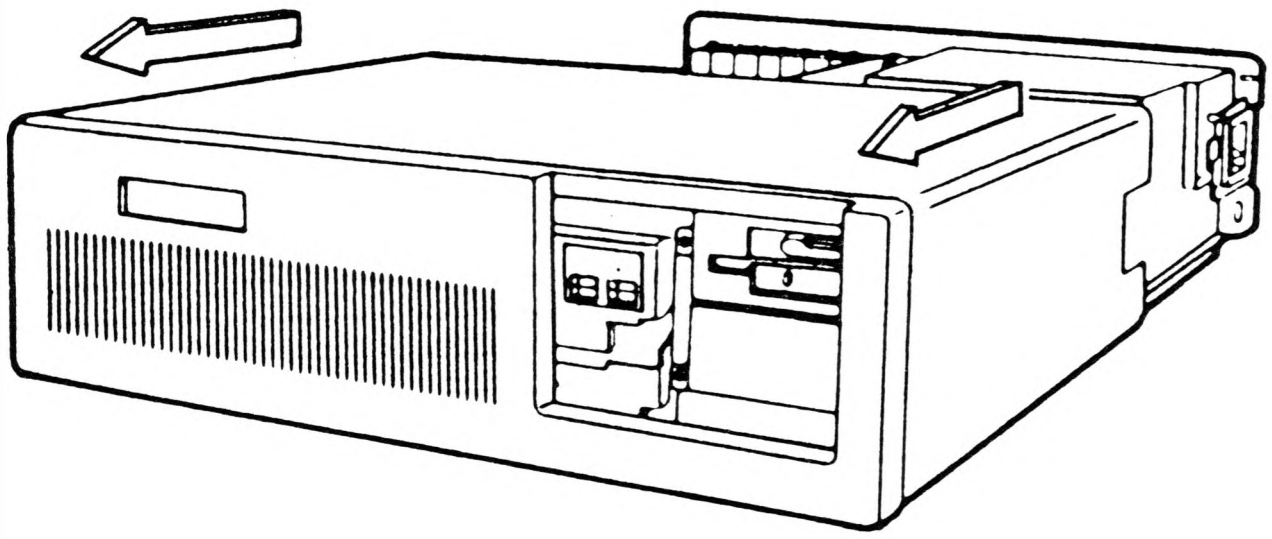


Figure 26: Removing the cover of the 1800

If the cover won't budge at all, check that:

1. You got the right five screws. The cover mounting screws are all the same size. If you took out a different-sized screw, replace it right away and check Figure 25 again.

2. The chassis isn't locked. Examine the front panel of the 1800 and locate the lock.

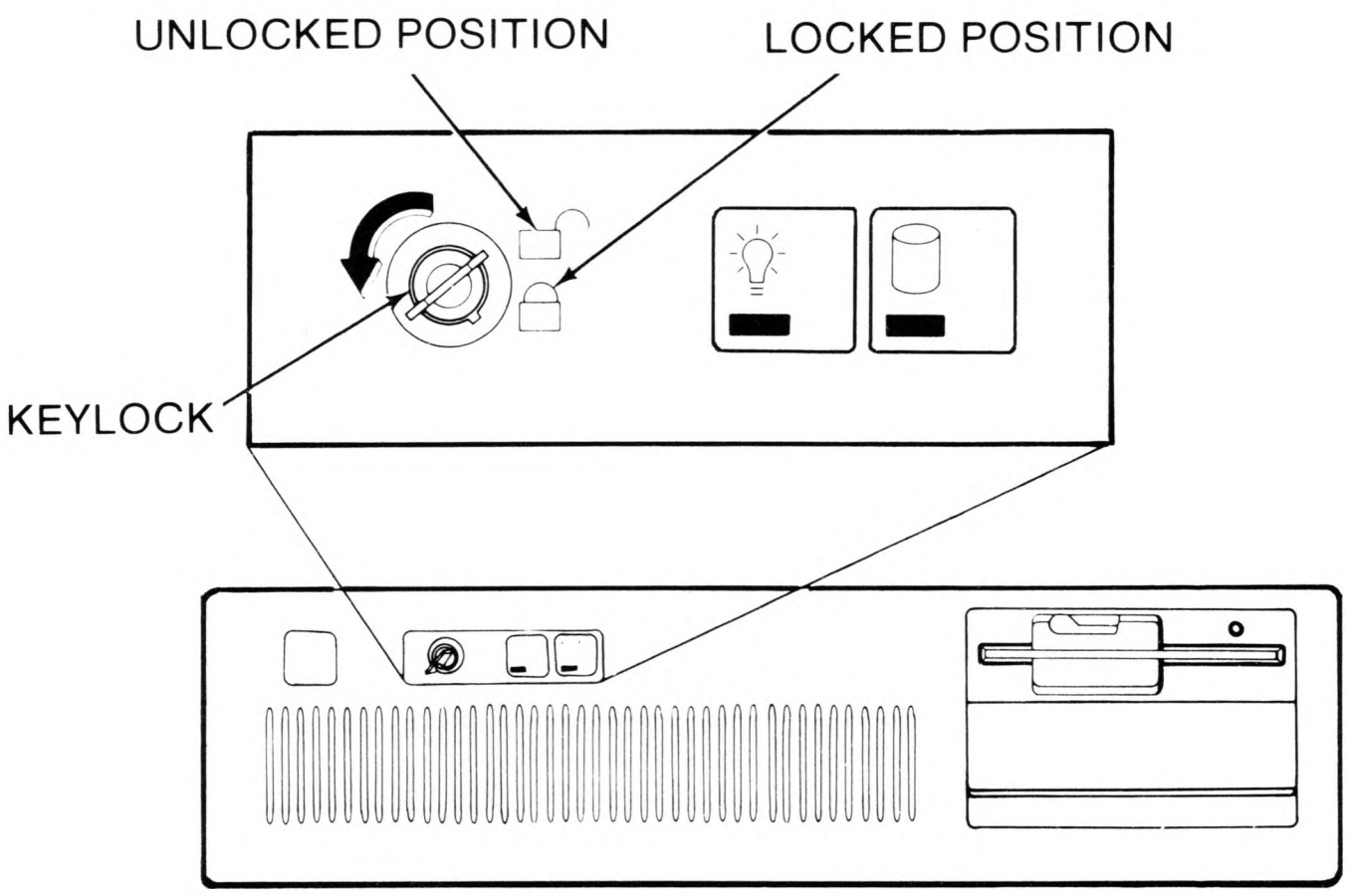


Figure 27: The lock on the front of the 1800

If the notch in the center of the lock is turned toward the lower, closed-padlock symbol, the system is locked. To unlock it, locate the two keys hanging from the back of the chassis. Snip away the plastic band holding the keys in place. Unlock the chassis and try again.

If the cover slides off part of the way and then you encounter some resistance, it's probably caught on a cable inside the system. Don't try to yank it off. Gently slide your hand under the back edge of the chassis cover, and press down on the cables. Then start sliding the cover forward again, being careful to keep it straight and level.

1. FIRST CONCEPTS

I'm not mechanically inclined. In fact, I grew up being told not to touch the back of the TV set. Why should I be taking off the cover of my new computer and fiddling around in there with a screwdriver?

There are two schools of thought on the subject of personal computers. One is the "black box" school. It says that the manufacturer includes a set of features that come with the system, and that's it. You never add features, you never upgrade, and you never need to know what's going on inside the system box. If it breaks, a repair person comes and fixes it. If you see a new feature that you want, you make a note to remember that next time you're ready to buy a new system. You can operate any computer according to the "black box" theory if you want to.

The second school of thought might be called "bare bones" because the computer itself provides only a framework, which you flesh out with **peripheral** (add-in) parts that tailor the system to your needs and budget. If a new gadget becomes available and you want it, you just buy the part and add it in. The ability to do this lets you keep an old system current for many years by updating it constantly as your needs grow.

The "bare bones" theory can save you a whole lot of money over the "black box." If you have even a nodding acquaintance with the insides of your system, you can make much more informed decisions about what parts to buy, and you can usually install new parts for yourself. Parts that are really broken will always require professional service, but you can take responsibility for much of the "health maintenance" of your computer system.

In addition to the money you save by making the best possible choice of peripherals, you can stretch your initial investment in a system over many more years and still enjoy the latest technology. People who are constantly trading in their outgrown black boxes for newer black boxes are spending a lot of money just on the process of replacing obsolete systems.

Okay, I can save money by picking the parts of my system to match my own needs. But can't I undo those savings just as quickly by committing some horrible error while messing around inside my computer?

Yes, you can, but it's not likely to happen if you exercise reasonable caution. Here are a few "Golden Rules" for novices using computer hardware.

2. GOLDEN RULES

- A new computer is not like a new toaster that you simply take out of the box and plug in. For a brand-new user installing a brand-new computer, the getting-to-know-you process is likely to require both time and patience. Don't start this project when you are running short of either.

- Watch out for static electricity. Your body can pick up static without your even noticing it, especially in carpeted rooms or in dry weather, and even a mild static shock can damage the delicate electronics of a computer. To protect against this, *always* touch your system chassis before touching exposed electronics. This is one habit that will serve you well for the rest of your computing career.

- Never, never, never let loose metal parts remain in your computer when it's turned on. If you accidentally drop a screw or a paper clip in there, you must get it out before you apply power to your system. If a metal part is touching any of the circuit boards in the system, it can cause a short-circuit, which may cause the computer to smoke and may damage it beyond repair.

- If you ever smell something hot when you start up your system, shut it down **immediately** and then unplug the power and all other cords. Bring the unit to a qualified service person. This very seldom happens, but it's a sure sign of serious trouble, and your prompt reaction is necessary to limit the extent of the damage. Don't fool around with this or try to re-start the system to see if it does it again.

- Before you start to change something, make a written note of the way it was before. That way, if all else fails, you can get it back the way you had it in the first place. For instance, many add-in parts, as well as your 1800's system board, have **dipswitches**. A dipswitch works like a light switch, except that there is usually more than one switch present at a time. If a manual tells you to locate a block of eight dipswitches and change the settings of three of them, first make yourself a little drawing of the original settings.

- Be careful about identifying the part that you're supposed to be working on. If you're told to change three dipswitch settings in dipswitch block SW2, make sure you're not looking at SW1 by mistake.

- When you're looking around inside the computer, try to have "tunnel vision." That is, if you're looking for a chip socket on the system board floor, don't worry about the ribbon cables that are in the way. Push them gently out of the way and look underneath them. There will always be a lot of different parts inside any computer, and if you're trying to figure out what each one is all at the same time you'll get tangled up.

- There is a fan on the back of the 1800's chassis. Do not set the unit so close to a wall that you block the flow of air to this fan. Likewise, do not obstruct the vents on the front of the chassis or the vents on your monitor. Air must move freely through the system in order for the 1800's cooling system to work properly.

- By the time you have your 1800 fully set up with its keyboard, a monitor, a printer, and maybe an external drive, you will have a lot of cords coming out of the system chassis. Keep all these cords untangled and out of your way. If the power cord is accidentally unplugged while you're operating the 1800, all the data in memory (not the data that has been stored; the difference between memory and storage is explained below) will be lost.

3. BITS AND BYTES

What are bits and bytes?

Bits and bytes are units of measure for data in computer form, just like "cups" are units of measure for food in huckleberry form. You can't look at a huckleberry bush and expect to see "cups," but you know that if you harvested the whole bush you would be able to measure the number of cups of huckleberries.

The word "bit" is a contraction of "binary digit." There are two digits in the binary numbering system: 0 and 1 (known to the computer as OFF and ON). So a bit is the smallest unit of information that a computer can work with.

Eight bits together equal one byte, or about enough information to define one letter of the alphabet.

One thousand bytes equal one kilobyte, commonly called a **K**, which is about a paragraph's worth of information depending on the format.

A K is a capacity to store or remember information, not a physical object. Therefore there is no correlation between how many K a floppy diskette can hold and how big it is. The same is true for K of memory: you can not set an open 256K computer next to an open 64K computer and expect to see 192 extra K inside the first one.

4. IBM COMPATIBILITY

I know my 1800 is IBM-compatible but I'm not sure what that really means.

The virtue of having an IBM-compatible computer is not just that you can add to it parts made by IBM. Of course you can do that, but the real advantage is that your system will accept IBM-standard hardware and software offered by a whole host of manufacturers. The world's greatest selection of programs, accessories, and parts is yours to choose from.

Of course, a compatible system or peripheral cannot be exactly identical to the corresponding IBM part; that would be illegal. There will always be some "shades of gray," but as a rule the IBM standard of interchangeability works remarkably well.

What's the difference between a PC-compatible and an AT-compatible?

The original IBM PC and all its compatibles are built around an 8088 microprocessor. The IBM AT and its compatibles (including the 1800) use the 80286, a next-generation chip that handles twice as much information at a time, and handles it faster. This is the kernel of the difference. There are other, more obvious changes between the two categories of machine. (The price tag is one of them.) AT compatibles tend to come in bigger chassis and to have only one front-access drive bank instead of two. But the most important difference is that the AT class of machines are faster and give higher performance than the PCs.

Does that mean that the ATs are not PC compatible?

No. The AT-compatible computers are **upward compatible** with the PC-compatibles. This means that an AT can duplicate all the functions of a PC, and then has its own more advanced features too.

What can I do to avoid being stuck with an IBM-compatible product that doesn't work in my IBM-compatible machine?

This is another area where a little knowledge of the workings of your computer will serve you well. Look for three things in a peripheral product:

- **Speed.** The speed of a system is measured in Megahertz (MHz). The higher the number of MHz, the faster the system and the better the performance. The speed is determined by a crystal (which looks more like a folded-up foil gum wrapper than a crystal) on the system board. (Remember that the system board is flat on the floor of your chassis). The 1800 comes with a crystal that runs at 8 MHz. That's relatively fast, and not all add-in parts are designed sturdily enough to run at that speed. Therefore, you can slow down the 1800 to 6 MHz by taking out the old crystal and substituting in a new one. CHAPTER II: ENHANCEMENTS gives specific instructions on how to do this. This replacement will cost you some performance but widen the choices of peripherals available to you. The best solution is to keep the 1800 running at 8MHz and shop for peripherals intended to run at this high speed. In any case, you should always know the speed of your system and ask about this issue before you buy a product.

- **The Data Bus**. The system's data bus works like a bus in a real neighborhood: it drives around from place to place picking up data and dropping it off. (There isn't really a little bus in there, but the theory is the same.) There are two types of buses: eight-bit, which works on eight bits of information at one time, and sixteen-bit, which works on twice as much. When you add a circuit board into one of your expansion slots, it joins the bus route by a gold-striped tab that plugs into the slot. (Expansion slots and circuit boards will be explained below in more detail; just follow along for now.) It's easy to tell whether a board has an eight-bit or sixteen-bit bus by looking at the tab. The eight-bit bus has one tab.

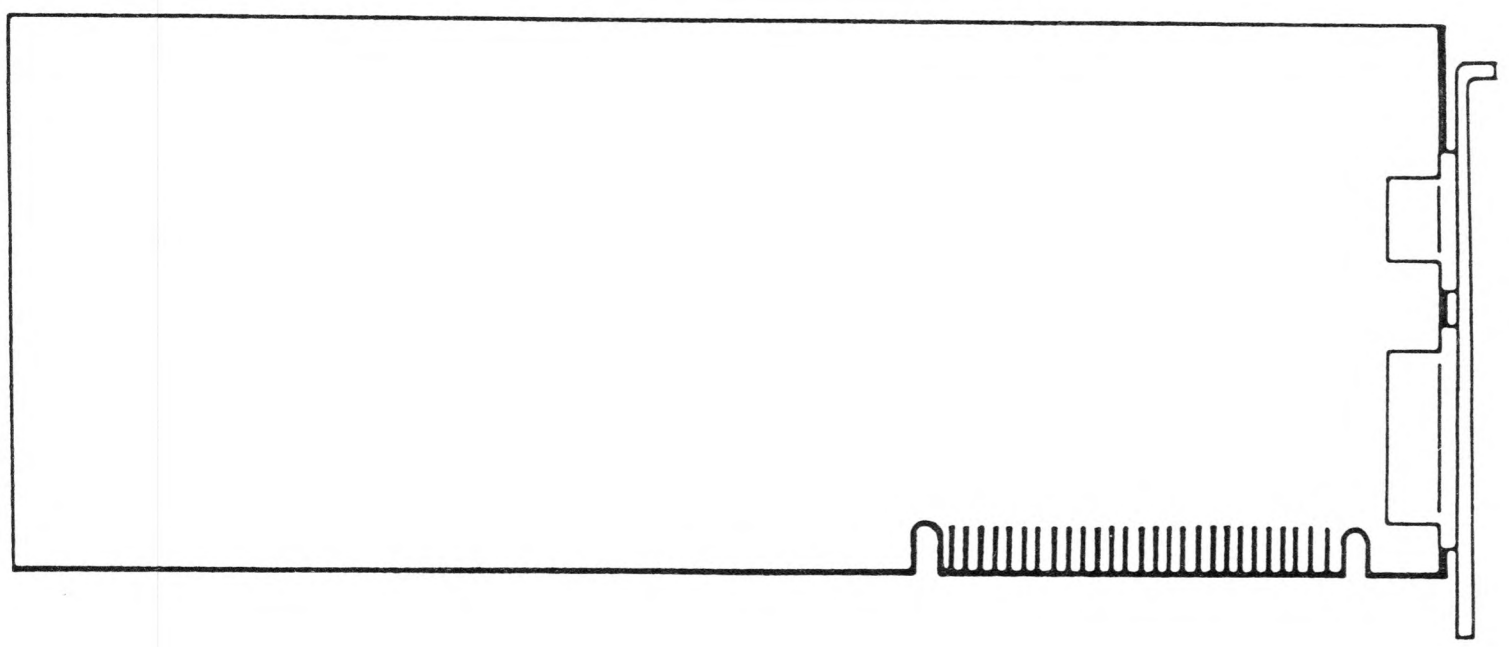


Figure 28: Expansion card with an eight-bit bus

If the board has a sixteen-bit bus, there will be an additional tab on the bottom.

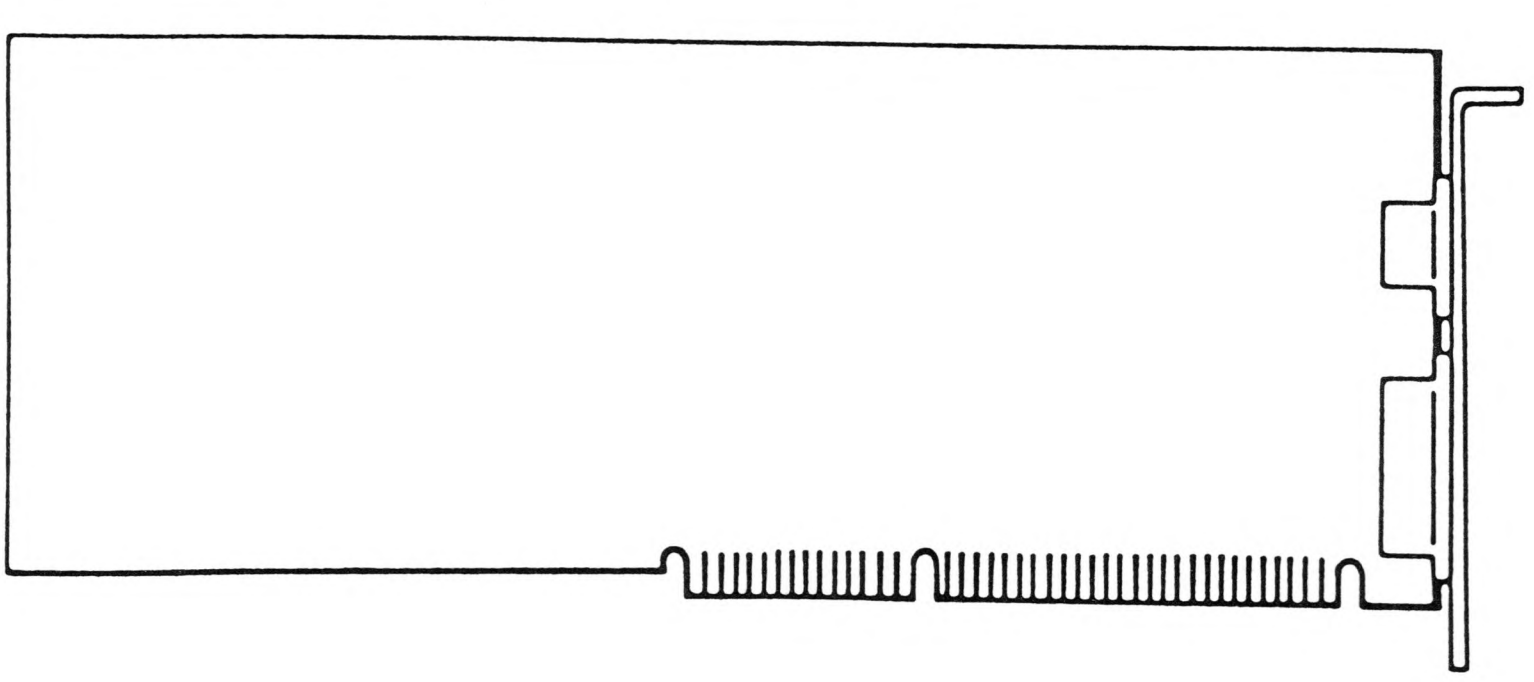


Figure 29: Expansion card with a sixteen-bit bus

The 1800 uses a sixteen-bit bus. However, two of its eight expansion slots are specially designed to accommodate an eight-bit card. When you look in the left rear quadrant of the system chassis you will see the expansion slots. The ones with two grooved black bars are for sixteen-bit tabs; the ones with one bar are for eight-bit tabs. Since there are three times as many slots for sixteen-bit tabs, you should pick sixteen-bit products whenever you can.

- **Configurability**. There are several of what we will call, for now, "parameters" inside any system. Think of a parameter as having five settings, 1 through 5. Only one product at a time may occupy each setting (although not every product requires one of these settings). You can see the potential for conflict if two manufacturers put out products that both require Setting 2. You buy both products and they won't work together. A configurable product would let you switch it to a different setting. This feature adds complexity and doesn't have any obvious value when you're staring at the product in the store, but it's worth knowing about before you buy.

5. EXPANSION SLOTS

What are expansion slots, and why are they so important?

The slot is what allows you to add extra circuit boards (the terms "board" and "card" are used interchangeably when referring to these) to upgrade your system. If you look in the left rear quadrant of your system box you will see the expansion slots.

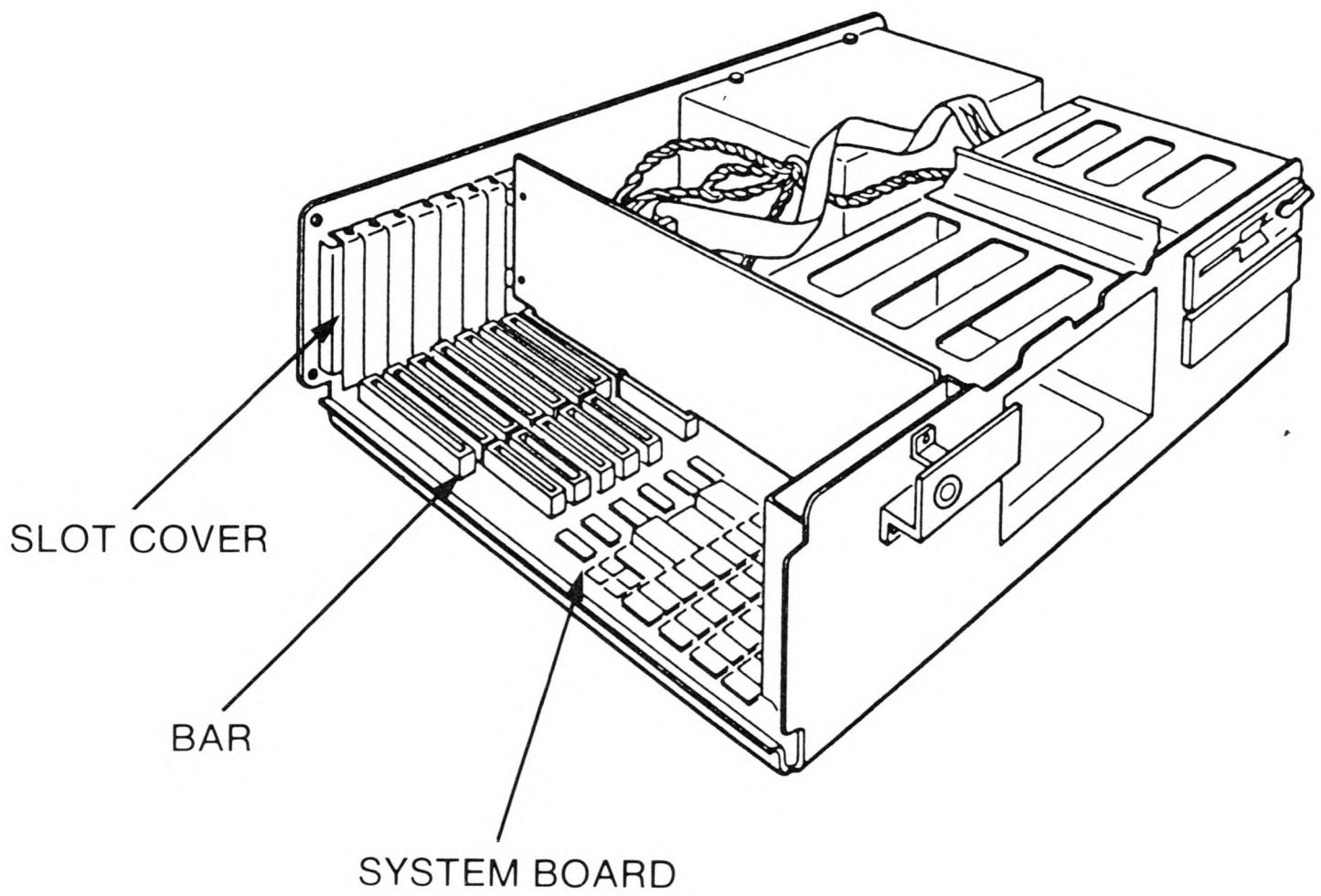


Figure 30: Expansion slots in the 1800

Each slot consists of:

1. The bar on the system board,

2. The rectangular hole in the back of the chassis (these are covered by narrow metal plates called slot covers then the slot is empty and by the endplate of the expansion card when the slot is full), and

3. The empty space available for a card to occupy.

When you install a card in an expansion slot, you first unscrew and throw away the slot cover. Then you insert the tab(s) into the bar(s) to connect the card to the data bus (see above). Finally you replace the slot cover screw to secure the endplate of the card to the back of the chassis.

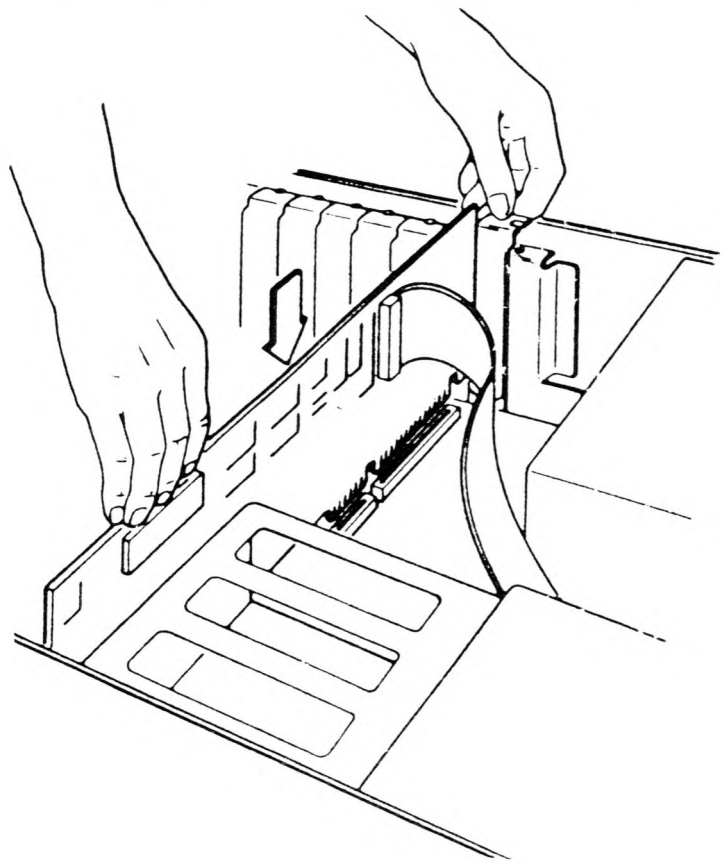


Figure 31: Installing a card in an expansion slot

Don't worry about mastering this process yet. It will be explained again before you are expected to actually do it.

Getting back to the eight-bit and sixteen-bit buses. What if I run out of eight-bit slots, and the next product I want to add is available only with an eight-bit bus? Is there any way to install an eight-bit card in a sixteen-bit slot?

Maybe. There are some eight-bit cards that are **physically compatible** with a sixteen-bit slot, and some that are not. The way to tell the difference is to look at the bottom edge of the card next to the eight-bit tab.

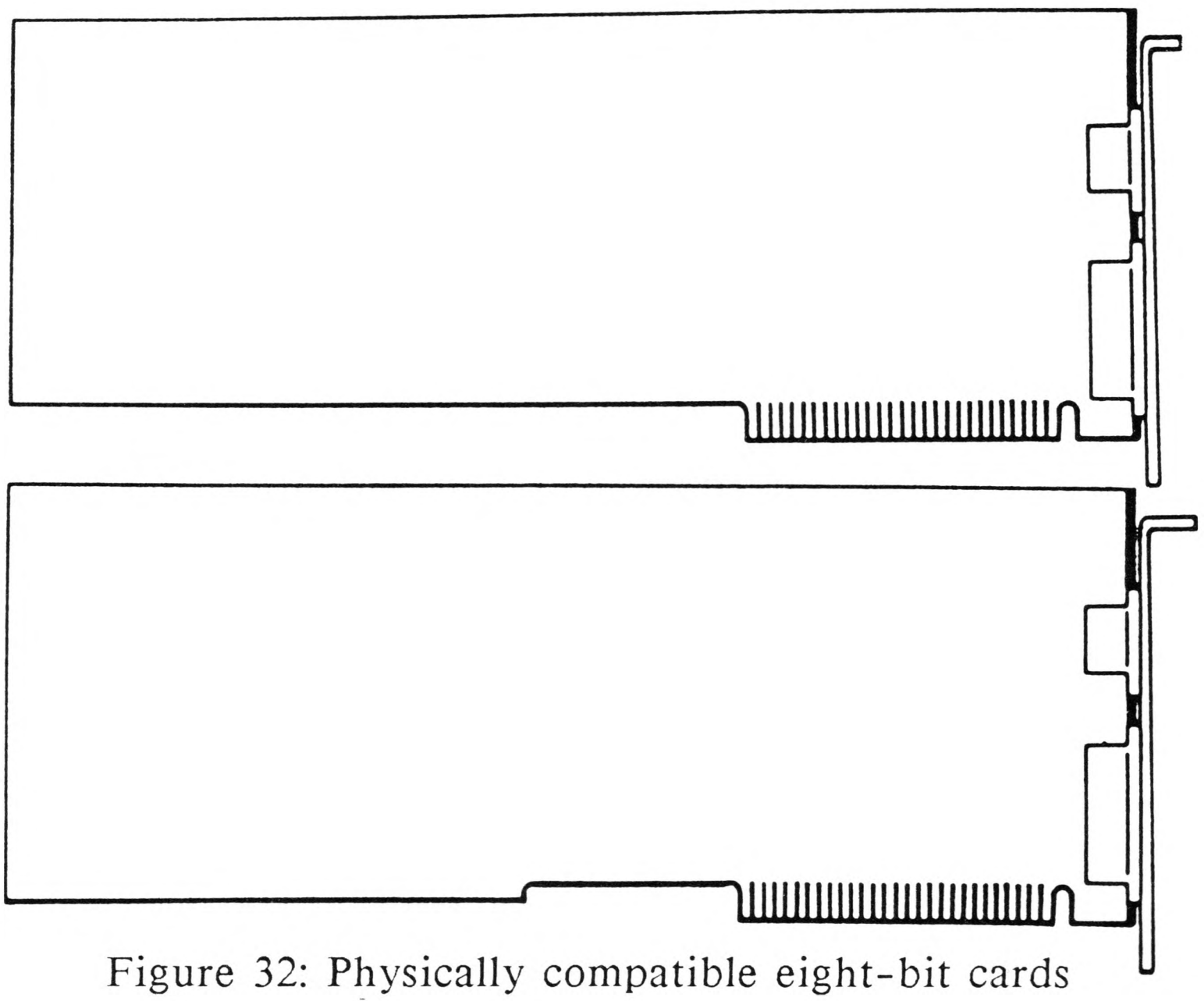


Figure 32: Physically compatible eight-bit cards

If there's a wide cutout piece missing from the card next to the eight-bit tab, or if the edge goes straight out from the tab, it's physically compatible.

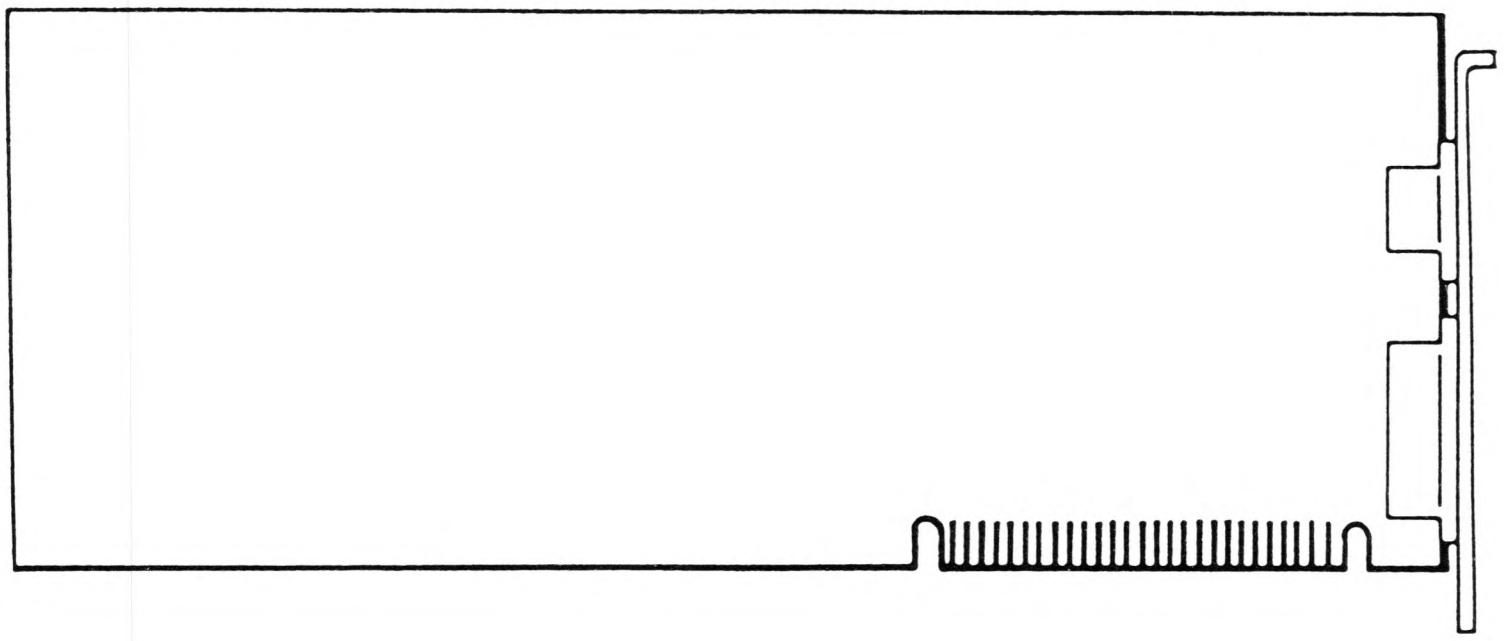


Figure 33: Physically incompatible 8-bit card

If the edge of the card dips down again next to the eight-bit tab, it's physically incompatible. You can't install this card in a sixteen-bit slot because the filled-in part will bump into the second bar on the system board.

Even if you've identified a card as being physically compatible with a sixteen-slot, ask the dealer before you buy it to be sure that the card is made to run in a sixteen-bit slot.

What's the endplate of the card for?

The endplate serves three purposes. First, it provides a space for external parts (like a monitor or a printer) to plug into the card.

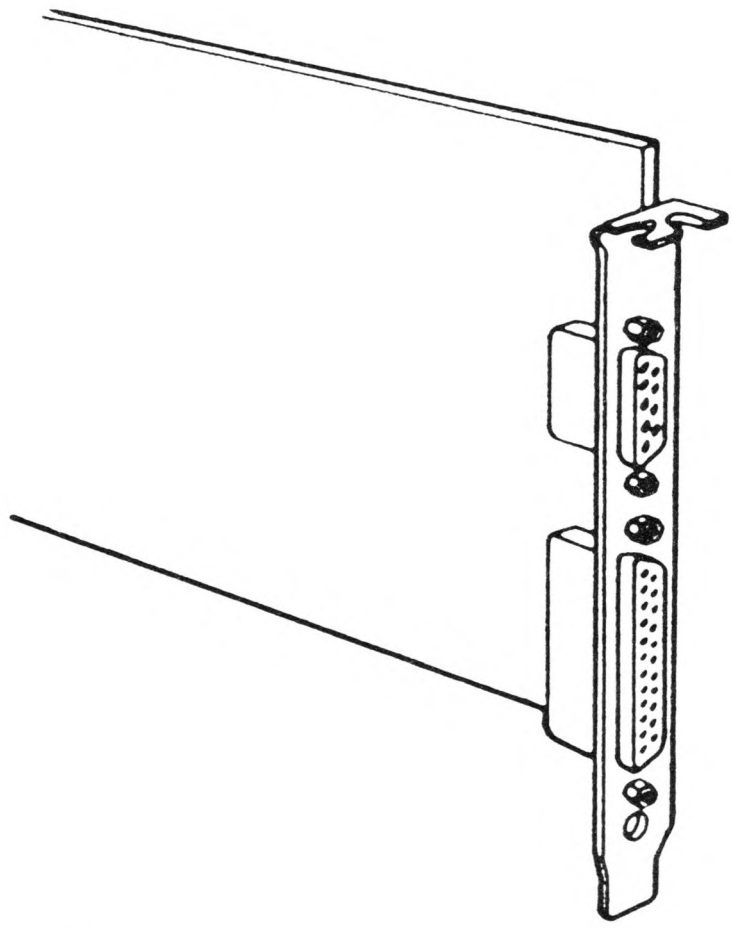


Figure 34: Endplate with connectors

Second, the endplate bracket anchors the card to the system so that it cannot be shaken free or bump into the card next to it.

NOTE: Adjacent cards in a system must not be allowed to touch each other! An unintended electrical connection may cause damage to the cards.

Finally, the bracket covers up the hole in the back of the chassis, which makes the system more attractive and minimizes the possibility of radio interference.

I've seen "short" cards that are less than half the length of standard cards. Can I use them?

Short cards were invented for the IBM XT and various compatibles, which have one or more expansion slots behind the left-hand drive bank, where only about half the usual room is available. These short slots work the same as long slots but require a card that fits physically into a small space. The 1800 has no short slots.

You can use short cards in the 1800 if you bear in mind that they are all eight-bit cards, and look for the same features when selecting them (speed, configurability, and physical compatibility with a sixteen-bit slot) that you use for any eight-bit card.

6. POWER

How much electrical power does the 1800 have, and how is it used?

The 1800's power supply looks like a silver cube in the right rear quadrant of the chassis. It's a 192-watt power supply, which means you'll most likely never need to augment it with an extra power supply. The unit's power-on switch is part of the power supply, as are the internal cables that apply electricity to the drive(s).

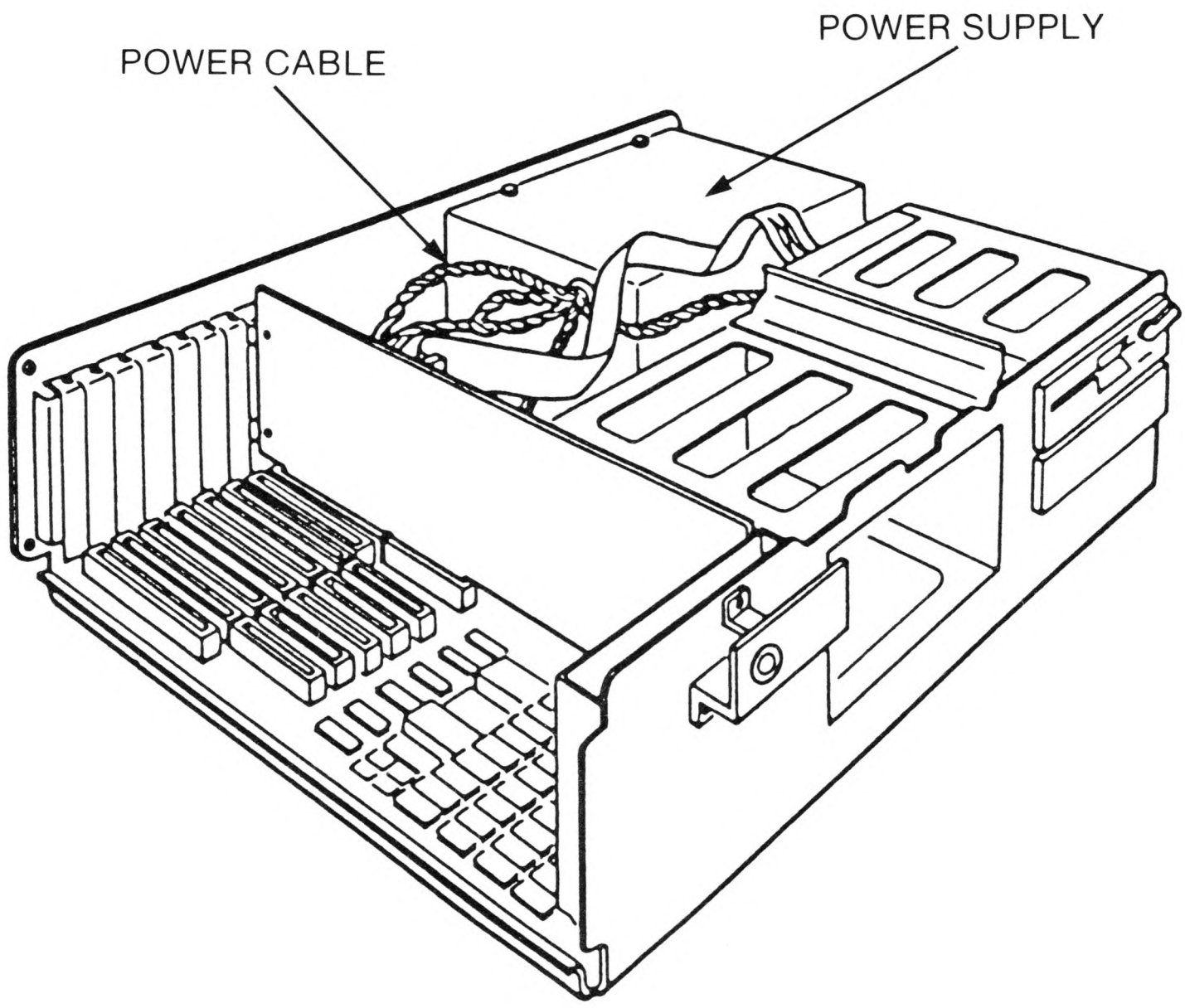


Figure 35: The 1800's power supply

The small red slide switch on the back of the chassis lets you select 220 volts operation when you use the 1800 outside the United States. Leave it at the 115 volt setting while you're in the United States.

What if I run out of internal power cables?

There are four internal power cables coming from the 1800's power supply. It's highly unlikely that you'll ever need more. If you do, however, you can get an inexpensive "Y" power cable that connects to your last free cable and splits its output in two. Do not use more than one Y cable per system. Remember that it is possible to overload your power supply if all your peripherals are unusually power-hungry.

I count six twisted cables coming out of my 1800's power supply. What are the other two?

Look closely and you will note two cables from the power supply that are already plugged in to the system board on the floor of the chassis. These cables are needed to power the system board. Don't unplug them or try to use them for any other purpose.

Where do my cards get their electricity?

They get it through the gold-striped tabs. The only time you'll connect a power cable to a card is when the card controls an external drive, and that drive doesn't have its own power cord directly to the wall. In that case, power would flow from the 1800's power supply through the controller card into the external drive.

What's the difference between a ribbon cable and a round cable?

A ribbon cable has the wires laid out flat next to each other, while a round cable arranges them in a circle.

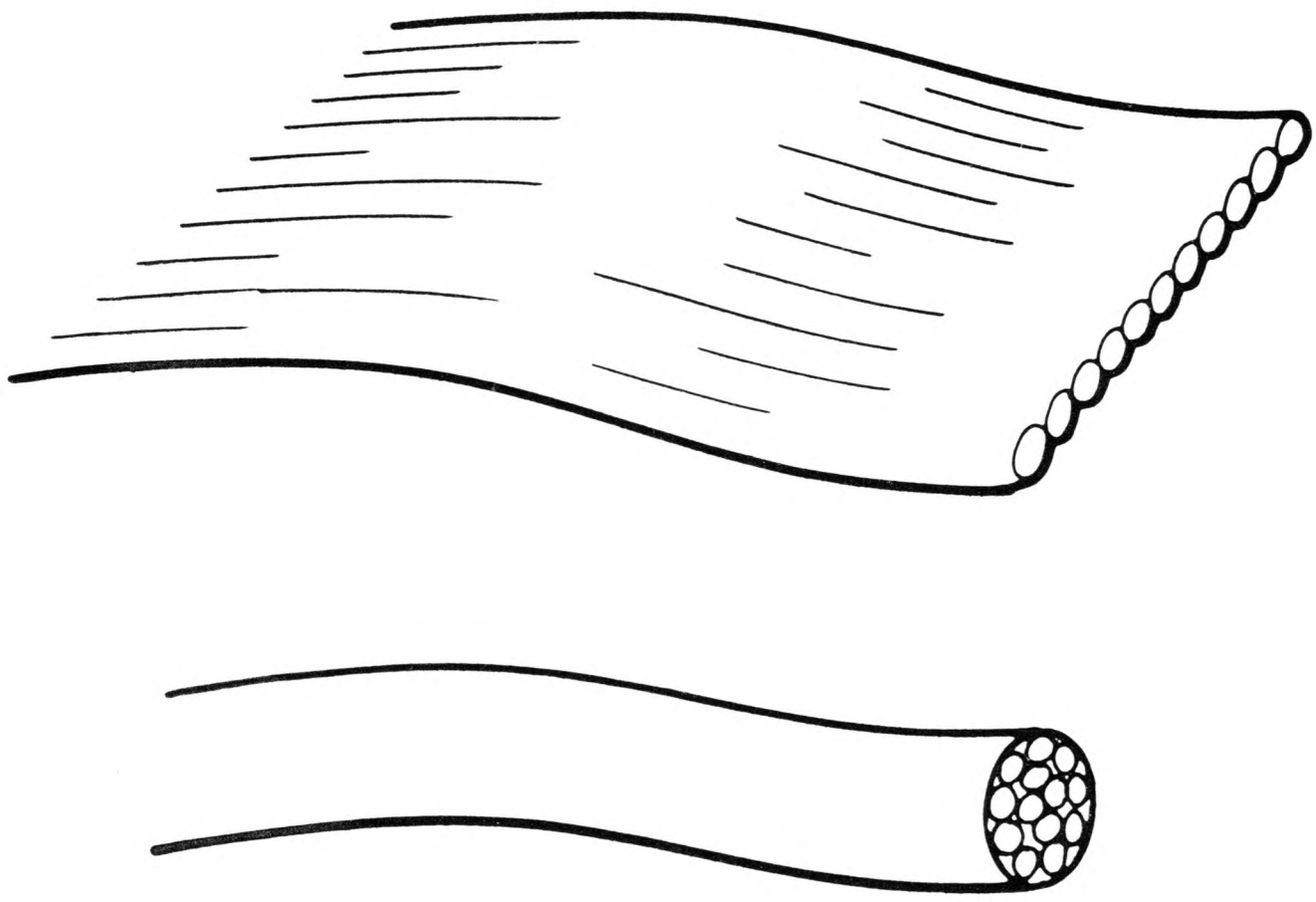


Figure 36: Ribbon and round cables

Ribbon cables are inexpensive and easy to make, but they allow more radio waves to escape than do round cables, and they aren't as durable. As a rule ribbon cables are acceptable for use inside the system chassis, but *all* the cables that extend out of the chassis should be the round kind.

7. DRIVES

What is a drive?

A drive is a motorized device that stores information on a magnetized surface.

There are three types of drives that you're likely to install in the 1800: a floppy disk drive, a hard disk drive, and a tape drive. Every drive has a motor that physically moves the **medium** (magnetic surface) on which information is stored. Also, every drive has a **controller card** that adapts it to the 1800.

Tell me about floppy drives.

The first thing to know about floppy drives is that you have one in the 1800.

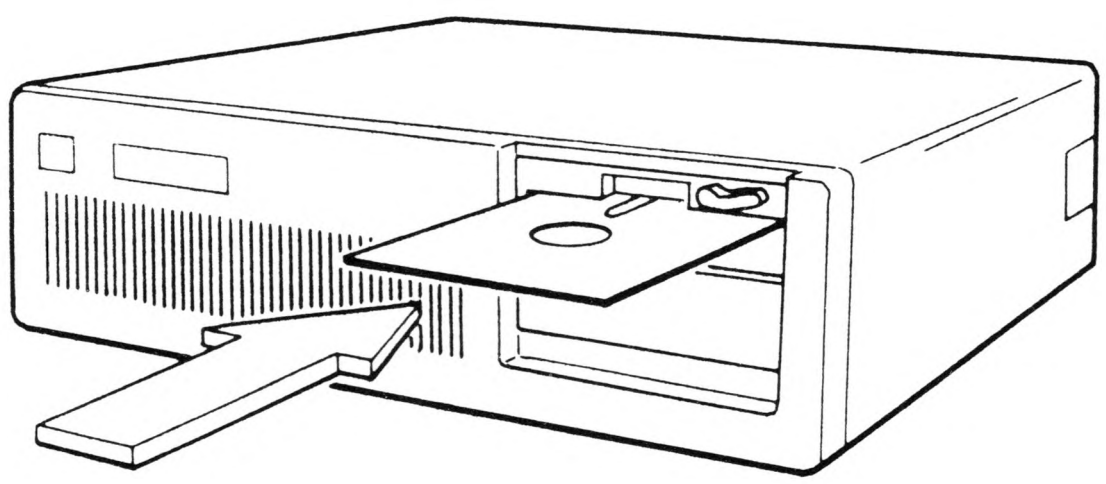


Figure 37: The floppy diskette drive in the 1800

A floppy drive is made to read information to and from floppy diskettes. This is the most common, inexpensive method of moving information from one system to another. When you buy a program it will come on a floppy diskette, and you will read in into your system via the floppy drive.

The floppy drive in the 1800 is a 5 1/4" drive, the most common format. There are three types of IBM-compatible floppy diskettes available: **single-sided**, which hold 160 or 180K, **double-sided**, which hold 320 or 360K, and **high capacity**, which hold 1.2 megabytes (1200K) per diskette. The floppy disk drive in your 1800 is a high capacity drive and can *read* information from all three kinds of diskette. It can *write* information on high-capacity diskettes and on some high-quality double-sided diskettes. There is no guarantee that the drive will be able to write on double-sided diskettes. Even when it does write successfully on a double-sided diskette, only another high-capacity floppy disk drive will be able to read that diskette. Therefore, when you buy blank diskettes, make sure you get the high-capacity kind.

Each diskette must be **formatted** before its first use. Since formatting erases all the information on the diskette, it should be done only once, when the disk is brand new. Your DOS and SETUP utility diskettes were formatted before information was recorded on them; do *not* reformat these diskettes. The details of formatting depend on the DOS you use; refer to your DOS manual for complete instructions on how to format a floppy disk.

For a complete description of floppy diskettes, turn to the section on diskettes, below.

What's a hard disk drive?

A hard disk (the same thing as a "fixed" disk) drive has a very high-capacity metal disk. (Floppy diskettes are plastic-based.) You can't touch the hard disk or take it out. Most high-performance systems such as the 1800 contain one or two hard disk drives to store large quantities of information. The system can access data on a hard disk more quickly than a floppy, so the operator doesn't spend as much time sitting idle. It's also much easier to organize data on a hard disk since it's physically all in one place. To store a lot of data on floppies you need to have an excellent filing system, and even so you may waste time reading one disk after another, looking for the file you want.

For more information about hard disks see CHAPTER III: PERIPHERALS above.

Why do I need a tape drive?

A tape drive is used to back up the hard disk drive(s). Although hard disks are a reliable means of storage, they do inevitably have failures, and since huge amounts of data are involved these failures can be catastrophic. It's easy to get a new hard disk after a failure but it's extremely hard, often even impossible, to get back the data that was on the disk. The process is very expensive, and there are few companies that will attempt it and none that will guarantee it.

The tape drive transfers data from the hard disk onto a tape (either a cartridge or cassette). With a good streaming tape drive (it's called streaming because the tape moves continuously with no stops and starts) the mirror image of a ten-megabyte hard disk can be backed up on tape in about two minutes. Then if the hard disk fails, the data can be put back, word for word and bit for bit, on the new hard disk. Or if a smaller amount of data - a single file, for instance - is accidentally lost, just that file can be retrieved.

For more information about tape drives see CHAPTER III: PERIPHERALS above.

What's the difference between storage and backup?

A storage device (like a hard disk) is a **random access medium**. That means that information can be written on it without regard for any particular pattern. When it's time to get the information back, the reading mechanism can access any point on the medium in any order, so it can reconstruct the information to its original form. Put more simply, storage devices were designed to be fast, with hard disks being even faster than floppies.

A backup device, like a tape, is not a random access medium. It is a **sequential access medium**, meaning that it has a beginning and an end. The reading mechanism can still access information from somewhere in the middle, but first it has to pass through all the information on either side. Backup is not designed to be as fast as storage. Instead it is designed to be very rugged and reliable.

Think of it this way: If you sat down at your computer and tried to call up from storage a file you had worked on yesterday, you'd be impatient if it took the hard disk drive two minutes to find the file. Since you use the hard disk drive many times a day, it's important that it be efficient and not waste your time. If you accidentally deleted that file and wanted to restore it from your backup tape, you would be less concerned about getting it back a few seconds faster and more concerned about its definitely, dependably being there on the tape.

Tape drives are expensive! Why can't I just use a second hard disk drive for backup?

Backing up on a second hard disk is worse than not backing up at all. The reason is that whatever causes your first hard disk to fail (an unexpected jolt to the system chassis, a power surge, or other accident) may very likely take out your backup disk at the same time. You will be left with no data and nothing to show for your investment in the second hard disk. Effective backup must be a **different technology** (i.e. tapes instead of a disk) from the primary medium, so that it is not vulnerable to the same set of problems. It must also be **removable**, so that you can transfer the backup to a different location. That way even if lightning, fire or theft strikes your computer, your work is protected.

By all means buy a second hard disk drive if you want one, but make sure you have a separate and reliable method of backup.

If I have two hard disks, do I need two tape drives?

No. One tape drive can back up any number of hard disks.

What's the difference between a cassette and a cartridge tape drive?

Cassette drives use little tape cassettes that look just like the audio cassettes that music comes on. However, they are not the same as audio cassettes and should not be confused with them. As a rule cassette tape drives are lower-capacity (up to about 20 megabytes), less expensive, and less interchangeable from one drive to another than cartridge tape drives.

Cartridge tape drives use heavy, rugged cartridges that are a quarter inch thick and backed with a metal plate. You can get cartridge tape drives in capacities up to 100 megabytes, but the most common capacity is sixty megabytes. Because the cartridges are so sturdy they are better suited than cassettes for archival storage: you save old data on cartridges, then erase it from your hard disk, thus freeing up space for new data. There are industry-defined QIC (for quarter-inch cartridge) standards for quarter-inch tape drives that assure interchangeability: that is, you can back up a disk in one office, remove the tape and send it to another office, and restore it to a different disk using a different tape drive.

What about internal and external drives?

All three types of drives (floppy, hard disk, and tape) are available in internal and external models. The internal models fit into an empty space in your system chassis, while the external models come in their own separate boxes and put only a controller card inside the system box. There are no general rules about price: sometimes one is cheaper, sometimes the other.

These are the advantages of internal drives:

- They don't take up any extra space (footprint) on your desk.

- They're convenient and tidy, and they don't add to your collection of cords and cables coming from the system chassis.

The advantages of external drives are:

- You can keep adding them even when you're out of internal space.

- An external tape drive can be shared among several systems, reducing the cost of backup per hard disk.

There's a lot more to know about the range of drives available on the market. You can find more information in CHAPTER III: PERIPHERALS above, and in the manual that accompanies each drive.

8. DISKETTES

What is a floppy diskette?

A **floppy diskette** is a round magnetic disk in a square plastic jacket, used for storing information in computer form.

The actual magnetic disk is visible through the oval opening in the jacket.

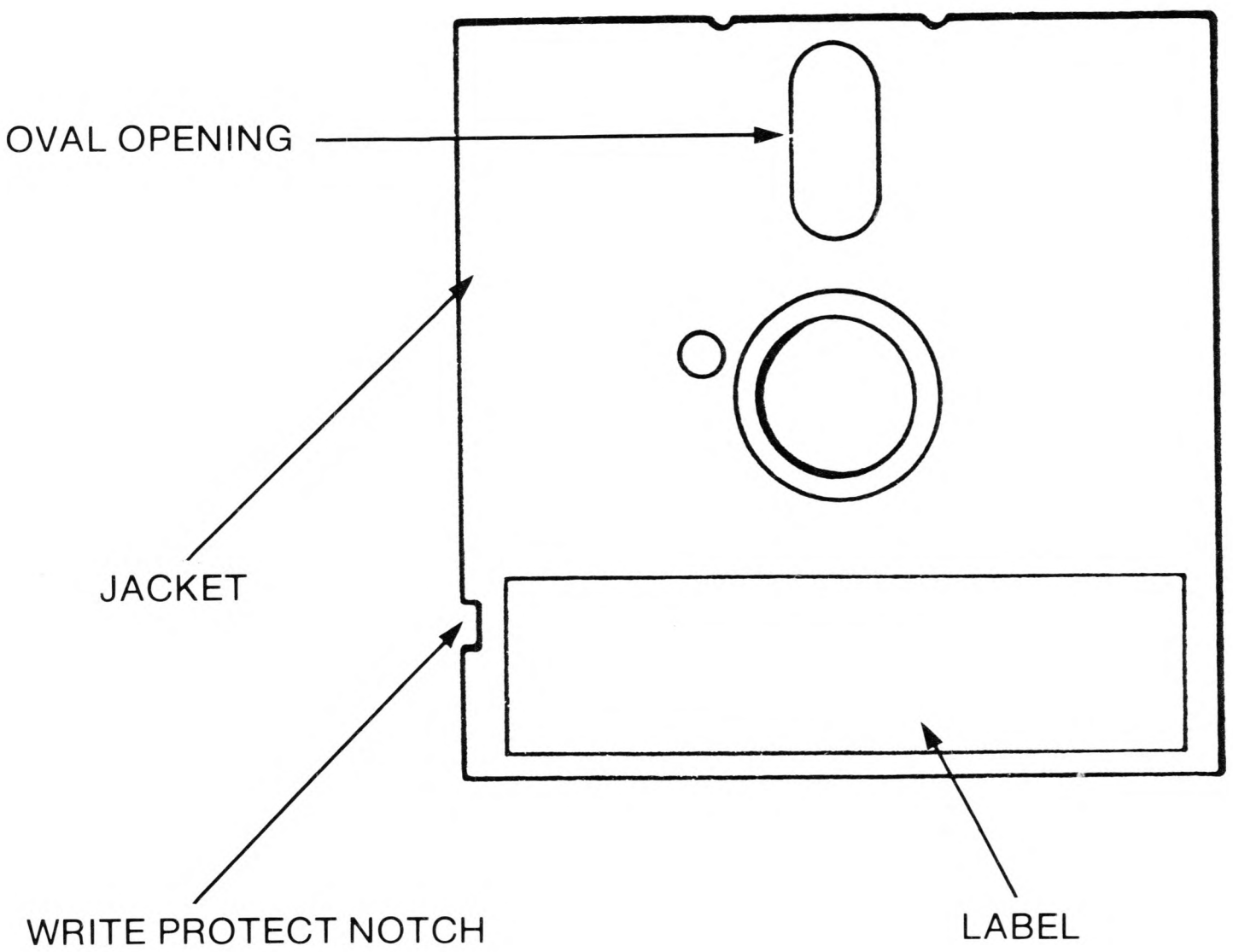


Figure 38: 5 1/4" Floppy Diskette

How can I safeguard the information on my floppy diskettes?

If you have valuable information on a diskette, you can **write protect** that diskette to guard against accidental erasure. Each diskette has a notch on the left-hand side. To write protect the diskette, cover the notch with either a write protect tab (supplied with blank diskettes) or a piece of Scotch tape. To remove the write protection, take off the tab or tape.

To protect your information, you should always handle your diskettes with great care. The following diskette care tips will bring long life and good health to your floppies:

Care Of Floppy Diskettes

- Each diskette you use should have a stick-on label. Do not try to write directly on the plastic jacket.

- Use only a felt-tip pen to write on these labels. If you use a ballpoint pen or a pencil you may crease the magnetic disk inside the diskette jacket. When possible, write on the label before you stick it on the diskette.

- When not in use, diskettes should be stored in individual paper sleeves. Never put a paper clip on a diskette.

- Keep your diskettes from sunlight, heat, and bending.

- Magnetic fields can distort the pattern of information on your diskettes, effectively erasing them. Be careful of household items such as children's' magnetic toys, screwdrivers and scissors with magnetic tips, and refrigerator magnets.

- Never touch the exposed magnetic disk. Handle diskettes only by the corners.

- Diskettes cannot be cleaned. You can only wipe them gently with a dry lint-free cloth.

- Diskettes cannot be gotten dirty in the first place. Keep them away from food and drink.

- Finally, remember that an ounce of prevention is worth a pound of cure. If you have valuable information on a diskette, make a backup copy and keep it in a safe place.

9. MEMORY

What's the difference between memory and storage?

You'll find out the hard way the first time you have a power failure while you're operating the 1800.

The difference between memory and storage is that information which exists only in memory is **volatile.** It requires an uninterrupted flow of electricity, or else it ceases to exist and there's no way to get it back. If you re-boot your computer, accidentally unplug it, or experience even a momentary flicker in your electricity, then only the information you had stored (on a hard disk or floppy) will remain.

That's terrible! Does this mean that if I've been working for hours on a document several megabytes long, and the electricity goes out even for a second, my whole document is instantly gone?

Yes. Data that hasn't been stored on a floppy or hard disk is always vulnerable to just such an event. For this reason, it's a good habit to store your work regularly during long sessions with your computer. Then you can only lose the changes you've made since the last time you stored your work.

You can buy special devices designed to protect your computer from this problem. When the power is interrupted, these devices jump in and maintain the flow to your computer long enough for you to store whatever you're working on. If you live in an area where power failures are common, such a device might be a good investment. But for most people, regular storing of data is an adequate precaution.

What is RAM?

Random Access Memory (RAM) is the capacity of the computer to remember information. Data in RAM is the easiest and fastest for the computer to access, since it's effectively "unpackaged" already. If you think of your computer as a desk, the RAM is the desktop. The bigger your desktop, the more things you can work on at once without having to put something away.

RAM comes in RAM chips. These are little electronic parts that look like bugs.

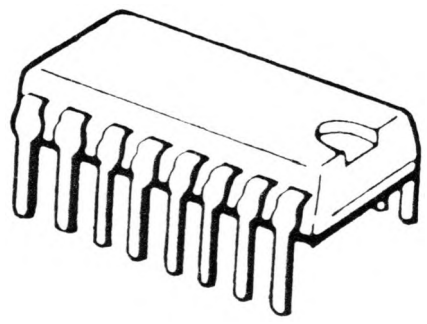


Figure 39: A RAM chip

NOTE: RAM chips are <u>extremely</u> sensitive to static electricity! Your body can pick up static, without your even noticing it, especially in carpeted rooms or in dry weather. If you touch a chip with static in your hands, the chip will be destroyed. However, it won't look any different, and you won't even know that it's broken until you try to use it.

To avoid inadvertent damage to a RAM chip, make it a habit to <u>always</u> touch your system chassis *every time* before you pick up a RAM chip.

Because RAM chips come in different capacities, you cannot tell by counting the chips how much RAM a system has. The most common capacities for RAM chips are 64K-bits and 256K-bits, but higher capacity chips are coming.

How does RAM connect into my system?

The pins of a RAM chip go into a socket on a circuit board (either the main system board on the floor of your chassis or an add-in board installed in one of your expansion slots) to form an electrical connection.

So I can just pop in a couple of extra RAM chips whenever I want a little more memory?

No. In all computers, RAM chips must be installed in certain patterns in order to work. You can't just add a chip here and a chip there; you have to add them in complete sets and add the sets in a particular order (see below).

How do you measure the capacity of RAM chips?

This is a little bit tricky. The capacity of individual RAM chips is measured in bits and thousands of bits, not bytes or thousands of bytes. A 256K RAM chip can hold 256 thousand bits. Remember that there are 8 bits in a byte. Therefore, if you want to add 64K *bytes* of RAM, you would install eight 64K *bit* RAM chips. Then you have to add a ninth **parity** chip to organize the first eight. Therefore, you generally buy RAM chips in sets of nine chips each.

How much RAM do I already have?

The 1800 comes with 512K of RAM on its system board. You can upgrade that amount to 640K or to 1 megabyte by installing more RAM chips on the system board.

Where is it?

While your 1800 chassis is open, look in the left forward quadrant of the box and locate the RAM chips.

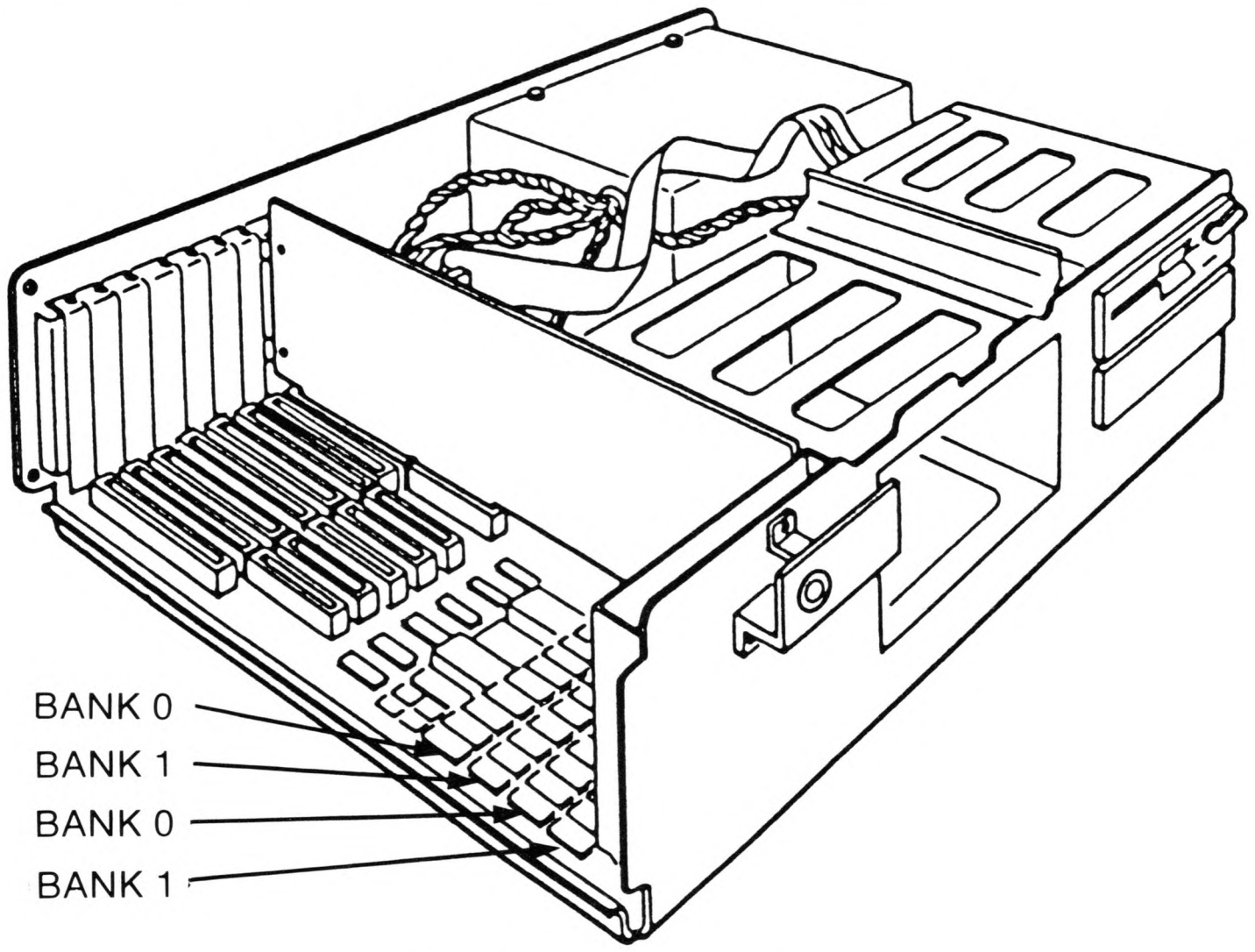


Figure 40: RAM chips in the 1800.

Note that there are four rows: two rows filled with chips and two rows of empty sockets. The rows filled with chips are **logical bank 0**; the empty rows make up **logical bank 1**.

Why are there 18 chips in each of the 1800's logical banks?

Because the 1800 is a sixteen-bit system (see the section on expansion slots above) each of its logical banks contains sixteen memory chips plus two organizers, not eight memory chips plus one organizer. That way each bank can send sixteen bits, one from each memory chip, onto the data bus at one time.

What's the advantage of adding chips to the system board instead of buying an expansion card with chips already on it?

Adding chips to the system board is a lot cheaper. For one thing, you don't have the card manufacturer marking up the price of the chips before you get them. For another thing, you don't have to pay for the card and control circuitry to support the additional chips. You have that circuitry already in place on the 1800's system board.

In addition saving money, you also save a slot.

If I want to upgrade my 1800's RAM, what chips do I buy?

If you want to upgrade the 1800 to 640K memory, buy eighteen 64K RAM chips. The formula for figuring this out is as follows:

18 chips divided by two rows equals nine chips per row. Nine chips minus one parity chips equals eight chips actually adding memory, per row. 64K-*bits* times eight chips equals 64K-*bytes* per row. 64K bytes times two rows equals 128K bytes added to the system. 128K bytes plus the original 512K bytes equals 640K.

If you want to upgrade to 1 megabyte of RAM, buy eighteen 256K RAM chips. (Be sure to read the section on extended memory, below.)

If you want to *downgrade* your total system memory to 256K, you can do it by pulling out the two rows of 256K chips already installed and filling all four rows with 64K chips. There is really no intelligent reason for wanting to do this, but you might as well know that it is possible.

What's the difference between a parity chip and the rest of the RAM chips?

No physical difference at all. Any RAM chip could be the organizer if it happened to be installed in the ninth socket of the bank.

Is there anything else I have to know besides the capacity when I buy RAM chips for the 1800?

Yes. RAM chips are available in different **speeds**, according to how long it takes the chip to send a bit of information to the central processing unit. Chip speeds are measured in **nanoseconds**, or one-billionths of a second. The lower the number of nanoseconds, the faster the chip. Because the 1800 is a high-performance machine, its central processing unit needs chips that can deliver information very fast. The CPU cannot be kept waiting for a slow RAM chip. The recommended speed for RAM chips in the 1800 is **120 nanoseconds**. (Nanoseconds is abbreviated **ns**.)

Where can I get RAM chips?

You can buy RAM chips from computer hardware stores and through mail-order ads in computer trade magazines. The important things to ask for when placing your order are:

1. **Capacity**: get 64K chips if you're upgrading to 640K, 256K chips if you're upgrading to one megabyte.

2. **Number**: You need 18 chips. You cannot add 9 now and 9 later.

3. **Speed**: Specify 120 nanoseconds or faster. (A smaller number of nanoseconds is a faster chip.)

How do I install RAM chips in the 1800?

Complete installation instructions are given in CHAPTER II: ENHANCEMENTS above. If you've read everything in this section about RAM, you should have no trouble following along. The only new and important things to note are the orientation of Pin 1 relative to the socket and the correct dipswitch settings.

10. EXTENDED MEMORY

DOS (your Disk Operating System) is able to support, or know about, only 640K of user-addressable base memory.

In the 1800, memory is **linear**. That means that it proceeds (theoretically, not physically) in a straight line from bit 1 through the highest bit that you have. Figure 42 illustrates the memory line of the 1800.

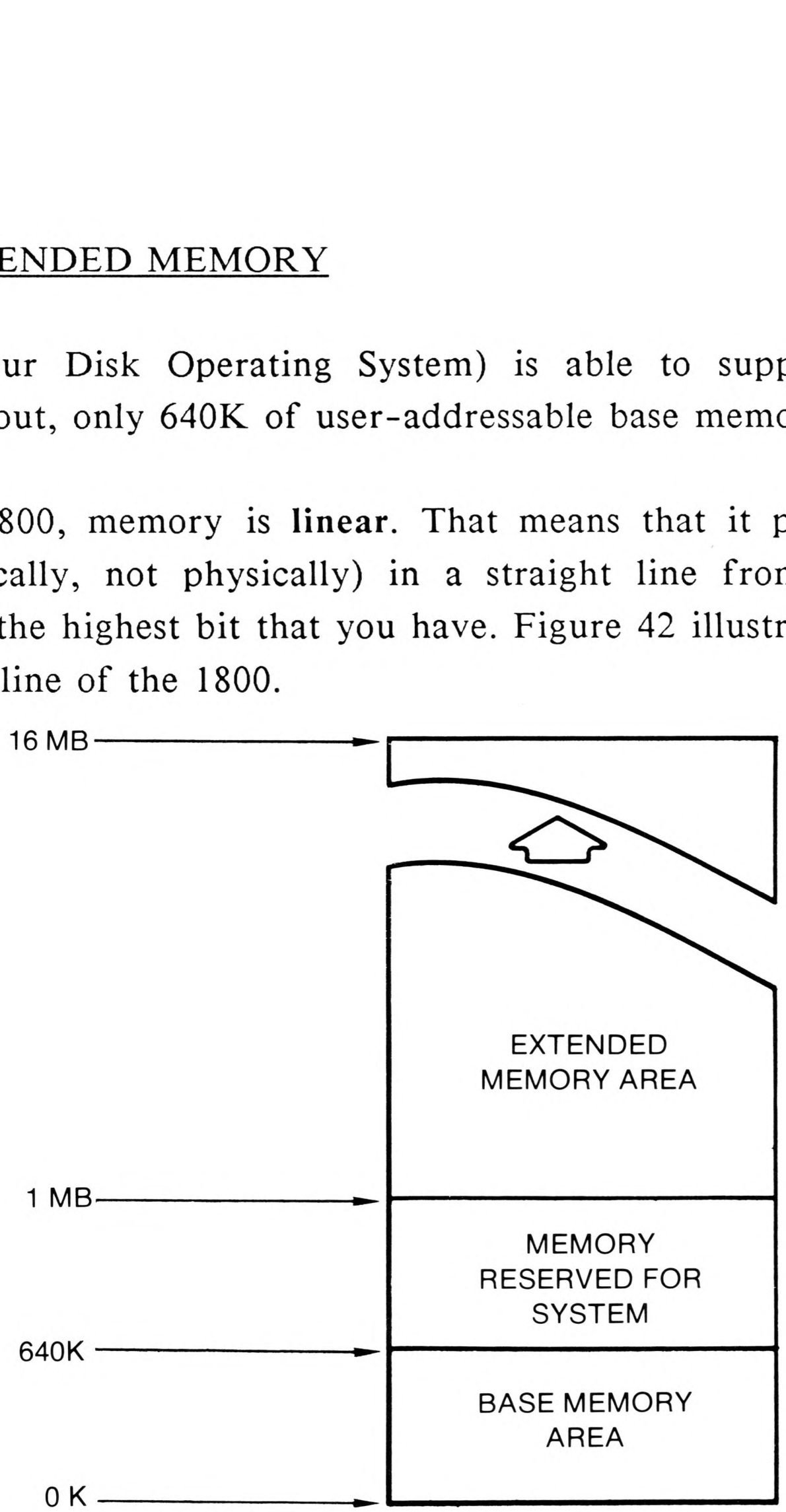


Figure 41: Memory Line in the 1800

The memory up to the 640K point is called **base** memory. DOS can use this memory for any purpose.

Memory from the 640K point up to the one megabyte point is **reserved** for **ROM**. ROM stands for Read Only Memory, and you can think of it as built-in permanent software that the system needs to perform its most basic functions. The user cannot have access to the memory in the reserved area between 640K and one megabyte.

Above the one megabyte mark, **extended** memory begins. DOS doesn't recognize extended memory, but certain specially-written applications programs do use it. Extended memory goes all the way from one megabyte up to sixteen megabytes.

So what happens if I install one megabyte's worth of RAM chips on my 1800's system board? Do the extra chips above 640K go for ROM?

No. ROM comes only on specialized ROM chips, which are already present somewhere else on the system board. If you install one megabyte's worth of RAM on the system board, the first 640K go for base memory, and the remaining 384K "jumps" above the reserved area to become the first 384K of extended memory.

If I can't use extended memory for ordinary DOS purposes, what can I use it for?

The most common use for extended memory is the **RAM disk.** Your DOS version 3.1 and above will include a program for creating a RAM disk in extended memory.

As the name suggests, a RAM disk is memory chips masquerading as a disk drive. DOS will treat it exactly like an extra floppy or hard disk drive connected to the system. Since there is no physical disk involved, access time to and from the RAM disk will be extremely fast.

Even though it acts like storage, a RAM disk is all memory. Do not forget to save the contents of your RAM disk onto a real storage device when you finish your computing session. And do not be surprised to find its contents vanished, along with the contents of your base memory, after a power interruption.

For the details about RAM disks, read your DOS manual.

In addition to the RAM disk DOS utility, there are software packages available that are specially written to use extended memory.

How do I fill up the rest of extended memory up to the 16 megabyte limit?

You add more RAM on expansion cards. Remember that DOS doesn't support extended memory; you'll need special software to make use of it.

11. DISPLAY

What is a pixel?

The word **pixel** is short for "picture element." Pixels are the tiny, individual points of light that make up the patterns you see on your screen. The **resolution** of a display is defined by the numbers of pixels across and up-and down. The higher the numbers, the better the display.

I know I need a monitor to see what my computer is doing. What else do I need?

You need a **video display adapter**. This is a card that goes in one of your expansion slots and "controls" the monitor. The display adapter and the monitor must be of the same type. That means that if you have a monochrome monitor, you can't use a display adapter that's for color monitors only.

There are dozens of display adapters on the market, each one with its own combination of fancy features. The Guide to Display Adapter Features below may help you to sort out some of the terms involved.

Guide to Display Adapter Features

Character cell: The area of pixels within which each character may be formed. The IBM standard is nine pixels across by fourteen pixels high. A smaller character cell may give you cramped, less readable letters and numbers.

Dual Monitor: This means that you can physically connect two monitors to the card at the same time. Either you will see the same display on both of them, or one will be inactive (blank), but you won't have to bother with switching plugs when you want to go from one monitor to the other.

Dual Display: The ability to run two monitors *with different displays on each one*, at the same time. This is a very advanced feature which is not supported by DOS, but several of the most popular software packages (including Lotus 1-2-3 release 2.0 and Symphony release 1.1) do support it. With a dual display card running one of these packages you might, for instance, have a graph on an enhanced monitor and simultaneous text on a monochrome monitor. You would type changes on the monochrome monitor, and the graph on the enhanced monitor would adjust automatically to show the changes. Manufacturers may sometimes claim dual display when they mean *dual monitor* support (see below), so you should clarify, before buying a card with this feature, that the seller is talking about dual, simultaneous, independent display on two monitors.

Enhanced Graphics: A relatively new and fancy graphics standard, which combines higher resolution with a larger palette (range of possible colors) to give you much better quality than the standard color graphics. Enhanced graphics generally means that the screen holds 640 pixels across by 350 pixels down, and has a palette of 64 colors of which any 16 may displayed at one time. To get enhanced graphics you need an enhanced monitor, an enhanced graphics adapter, and enhanced graphics software. Since there isn't yet a great body of enhanced graphics software, you should choose your EGA (enhanced graphics adapter) for its ability to run regular color and monochrome monitors and software, in addition to its enhanced features.

Extended display: Text that is 132 columns wide, instead of the usual 80 or 40. The advantage is that you can get more characters on the screen at one time, without having to scroll back and forth to see it all.

Graphics: There are color graphics and monochrome graphics (see Hercules, below). A "graphics card" cannot necessarily do both unless specifically stated. By itself, the word "graphics" just means that the adapter is able to produce pictures (as opposed to text) on your screen. The monitor screen is composed of pixels (see below), which are little points of light. A graphics adapter is able to set the attributes (what color, how bright, blinking or not) of each pixel individually, forming any pattern at all. Almost all adapters offer some kind of graphics.

Graphics Card: Another name for a display adapter that can do graphics.

Graphics Mode: When a display adapter can do both text and graphics, all the different kinds of graphics (different resolutions, different colors) that the adapter can do are called graphics modes. Note that the card can never boot up in a graphics mode, because the system requires text mode to display its DOS message and get your first instructions.

Hercules-compatible: Hercules Computer Technology set a standard for monochrome graphics. Many software developers followed suit, writing programs that relied on this standard to run. The rest of the hardware manufacturers followed the software developers, building Hercules-compatible cards that will run Hercules-compatible software.

The Hercules standard means monochrome graphics on a monochrome monitor, at 720x348 pixel resolution, using 64K of screen memory.

Hercules compatibility is a very good feature to have when you're running a monochrome monitor, since it adds to the number of programs you can run. You can still buy the Hercules Graphics Card that started it all. Since then, however, many monochrome display adapters have come along that work perfectly well with software written for the Hercules card and include many other advanced features too.

Hybrid mode: The ability to run color graphics software on a monochrome monitor. The different colors programmed into the software show up as shades (of green, amber, or whatever the one color is) on the monochrome monitor. This is an exceptionally useful feature if you have a monochrome monitor, since it allows you to run a great deal of software that otherwise wouldn't be available to you.

RC Jack: A connector that allows you to use a TV set as a monitor. Using a TV can save you the expense of buying a monitor, but the display you get will be uniformly awful. For a taste of what this is is like, try watching a one-hour TV show with your face one foot away from the screen.

Resolution: The number of pixels on the screen, measured horizontally by vertically. A larger number means a crisper, more legible display.

Screen Memory: Like guests who bring their own food to a dinner party, display adapters bring their own memory chips to your system. Adapters don't use up any of the host computer's memory, but they occupy a place at the table (see Memory above) in an area reserved just for them. And, of course, they don't share their memory chips with any of the system's other functions.

The usual amount of memory address space reserved by the system for display adapters is 64K. If an adapter (usually an EGA) has more than 64K of screen memory, it is supposed to swap memory in and out of its allotted 64K address range. It is not supposed to spread out 256K of screen memory.

Screen memory chips may be on the adapter board itself, or they may have to be added on a piggyback extender board. A piggyback board is an expensive and cumbersome way to add screen memory.

Text: Letters, numbers, and other pre-defined characters produced by a character generator chip on a display adapter. Because the adapter already "knows" the pattern of each character, text is faster and easier than graphics (which require every pixel to be controlled individually) for the card to display. Every display adapter can do text.

Text mode: When an adapter is in its text mode, only characters known to the character generator chip can appear on the screen. When a graphics mode takes over, all points on the screen are set individually.

What else should I consider when looking at video display adapters?

Remember to look for the same basic features that you check for in any peripheral card: speed, sixteen-bit compatibility, and configurability (See IBM Compatiblity for more information on these features.)

In addition, some display adapters will have a serial or parallel port in addition to the monitor connector(s). This is because most users will need to add a printer to the system. It's possible to get a card exclusively for the printer, but it's more economical (in dollars and expansion slots) to pick up the port you need on a card that's already present.

12. PORTS

What's the difference between a serial and a parallel port?

Think of data moving from place to place as marching soldiers. They can go single file (or serially), or they can march eight abreast (in parallel).

Data moves through a serial port one bit at a time, and through a parallel port eight bits at a time. Generally speaking, parallel transmission is faster.

Where do I get the port I need?

Ports usually come on the endplates of cards.You can buy a special card that has just serial and/or parallel ports, or you can get ports on multifunction cards or display adapters. The multifunction card generally contains additional RAM, one or more ports, and sometimes other features as well.

13. DOS

What is DOS?

DOS stands for Disk Operating System, and it is the first and most fundamental software that your computer needs before all its other functions can work.

Suppose that every night before you go to bed, you take off your head and set it carefully on your night stand. In the morning when you wake up, the first thing you have to do is grope around for your head and screw it back on. Only then can you use your eyes, ears, nose, and mouth.

That is the way your computer works with DOS. When you flip on the power switch, the computer by itself knows only enough to look in its drives for DOS. First it checks the floppy drive(s) and then it checks the hard disk drive(s). If it doesn't find DOS, it can't do anything else.

What does "boot up" mean?

Boot up refers to this process of loading DOS that takes place when you first turn on the electricity. The very first time that you boot up your system, you must have a DOS diskette in the floppy drive. Then, if you have a hard disk, you can transfer DOS to that drive (refer to the section on formatting) and not have to bother with inserting a floppy in the future. You must not have a non-DOS diskette in your floppy drive when you are trying to boot up. When the system goes out looking for DOS, it will stop when it gets to the diskette and will generate an error message. Whenever you attempt to boot from a hard disk, make sure that the drive door lever on the 1800's floppy drive is flipped up.

Do not try to boot up the 1800 until you have finished installing all your peripherals, replaced the cover on the chassis, and followed all the steps discussed in the CHAPTER I: INSTALLATION.

What's the difference between a "cold boot" and a "warm boot"?

A **cold boot** takes place when you physically disconnect the electricity to your system by turning the power switch off and on.

A **warm boot** is accomplished from your keyboard by simultaneously pressing the Ctrl, Alt, and Del keys. (Note that these keys have been deliberately chosen so that you can't do a warm boot by accident.) Sometimes a computer will **hang** when it runs across an error in software or hardware that it can't cope with. When the system is hung, you will be unable to get any response by using the keyboard, and may have to resort to a warm boot to get it going again. In rare cases where the system is badly stuck, a warm boot may not work; if this happens, do a cold boot.

Any kind of a boot will clear out any and all data in RAM. (See MEMORY above).

How can I tell when my system has booted successfully?

You will see one or more DOS messages on the screen, followed by a prompt. When you boot up from the 1800's floppy drive, you will see

A>

on the left side of the screen. After DOS has been transferred to a hard disk, subsequent boots will display a

C>

or

D>

depending on whether DOS is on your first or second hard disk.

When you see the DOS prompt you are ready to start computing. If you booted from a floppy, you can take out the DOS diskette and insert an **applications** (a general term meaning any program you use) diskette.

For more information on the various features and functions of DOS, refer to your DOS manual.

14. SOFTWARE

What's the difference between "software" and "hardware?"

If it's a program, magnetically recorded on a disk, that allows your 1800 to perform some new function (like word processing or figuring out your taxes) it's **software.**

If it's a piece of equipment that you can hold in your hand (including the diskette that the program comes on) it's **hardware.**

The system has some functions (software) permanently programmed onto chips (hardware). This is called **firmware.**

Then, in computer industry parlance, there's vaporware, which is yet-to-be-invented products. Avoid spending too much money on vaporware. Liveware refers to those endlessly useful people who know how to fix your computer when it's not working.

What is "menu-driven" software?

"Menu driven" means that the program will offer you a list of choices for what to do next. You use your cursor keys or function keys to select an entry from the list, just like ordering from a menu in a restaurant. The opposite of menu-driven software is command-driven software, which requires you to know in advance what it can do and type in a command. DOS is a good example of a command-driven program. If you don't know what commands to type in, you could sit staring at that A> all day.

Command-driven software is very unforgiving. It doesn't understand typos or operator mistakes. Your commands must be perfectly precise or the system won't be able to read them.

For this reason, menu-driven software has tremendous appeal for new users. It's easy to get started and hard to mess up. Even if the menus are cryptic and short, they don't leave the user in mute frustration with no idea of what to do next.

The down side of menu-driven software is that it limits flexibility and slows down performance. The first time you run a program, it's very nice to have a menu prompt you for the sequence of commands. The tenth time, you probably know the sequence by heart. The fiftieth time, it's downright aggravating to wait for the menu to generate and plod through all the choices to get the command you want. Sooner than they expect, most people get impatient with using the menu and wish you could just type in an exact series of commands.

Fortunately, many programs allow you to work both ways: they offer menus but also accept command lines. This is the ideal solution.

Appendix I: The System Unit

System Unit Specifications

Size:	21.3 x 17.3 x 6.8 inches
Weight:	42 pounds
Electrical:	110/220 volts

Central Processing Unit

The central processing unit of the 1800 is an Intel 80286 microprocessor which runs at 6 or 8 MHz.

1. SWITCHES

W1: On Board RAM Memory

The board may contain up to 1MB of RAM memory using 256K RAM chips or up to 256KB of RAM memory using 64K RAM chips.

256 K Bytes on board (Switch W1: 1 and 2 both ON)

Bank 0	filled with 64 K
Bank 1	filled with 64 K

512 K Bytes on board (Switch W1: 1 ON and 2 OFF)

Bank 0	filled with 256 K
Bank 1	empty

640 K Bytes on board (Switch W1: 1 OFF and 2 ON)

Bank 0	filled with 256 K
Bank 1	filled with 64 K

1 M Byte on board (Switch W1: 1 and 2 both OFF)

Bank 0	filled with 256 K
Bank 1	filled with 256 K

W2: On Board ROM

TABLE 5
ON BOARD ROM

	SWITCH W2	
ROM CHIP SIZE	ON	OFF
128 K ROM CHIPS (64 K BYTES TOTAL)	1, 2	3, 4
256 K ROM CHIPS (128 K BYTES TOTAL)	3, 4	1, 2

W3: Display Adapter

SW3 is used to select the display type (color or monochrome).

TABLE 6
SW3 SWITCH POSITIONS

SW3 (SLIDE SWITCH)	MONITOR
SLIDE TOWARD FRONT PANEL	COLOR
SLIDE TOWARD BACK PANEL	MONOCHROME

2. JUMPERS

External Battery Connector (J1)

PIN #	ASSIGNMENTS
1	+6V
2	N/C
3	Ground
4	Ground

Speaker Connector (J2)

PIN #	ASSIGNMENTS
1	Speaker
2	Key
3	N/C
4	VCC

Keyboard Inhibit Connector (J3)

PIN #	ASSIGNMENTS
1	Power on LED
2	N/C
3	GND
4	Signal In; keyboard switch
5	Ground; keyboard switch

Keyboard Connector (J4)

PIN #	ASSIGNMENTS
1	Clock
2	Data
3	N/C
4	Ground
5	VCC

3. INPUT/OUTPUT

I/O Connectors

- 62 Pin Standard (J15, 17, 19, 21, 23, 25, 27, 29)
- 36 Pin Extended (J14, 16, 18, 20, 22, 24, 26, 28)
- J16 and J26 are unconnected (same as IBM PC)
- All I/O channels are IBM PC/AT compatible

I/O Address Map

ADDRESS (HEX)	DEVICE
000 - 01F	DMA controller 1, 8237A-5
020 - 03F	Interrupt controller 1, 8259A
040 - 05F	Master timer, 8254
060 - 06F	Keyboard controller
070 - 07F	Real time clock, NMI (non-maskable interrupt) mask
080 - 09F	DMA page registers, 74lS612
0A0 - 0BF	Interrupt controller 2, 8259A
0C0 - 0DF	DMA controller 2, 8237A-5
0F0	Clear math coprocessor 80287 busy
0F1	Reset math coprocessor 80287
0F8 - 0FF	Math coprocessor 80287

ADDRESS (HEX)	DEVICE
1F0 - 1F8	Fixed disk
200 - 207	Game I/O
278 - 27F	Parallel printer port 2
2F8 - 2FF	Serial port 2
300 - 31F	Prototype card
360 - 36F	Reserved
378 - 37F	Parallel printer port 1
380 - 38F	SDLC, bisynchronous 2
3A0 - 3AF	Bisynchronous 1
3B0 - 3BF	Monochrome display and printer adapter
3C0 - 3CF	Reserved
3D0 - 3DF	Color graphics display adapter
3F0 - 3F7	Diskette controller
3F8 - 3FF	Serial port 1

ADDRESS (HEX)	DEVICE
00000 to 07FFFF	512K System board memory
080000 to 09FFFF	I/O channel memory - IBM Personal Computer AT 128K Expansion Option
0A0000 to 0BFFFF	128K Video Reserved for graphics RAM display buffer
0E0000 to 0EFFFF	64K Reserved: Duplicated code assignment on system board at address FE0000
100000 to FDFFFF	I/O channel memory 15 MB maximum- IBM Personal Computer AT 512K Memory Expansion Option
FE0000 to FEFFFF	64K Reserved: Duplicated code assignment on system board at address 0E0000
FF0000 to FFFFFF	64K ROM on the system board Duplicated code assignment at address 0F0000

4. DMA CHANNELS

TABLE 7

DMA CHANNELS

CHANNEL	FUNCTION
0	SPARE (8-BIT TRANSFER)
1	SDLC (8-BIT TRANSFER)
2	FLOPPY DISK (8-BIT TRANSFER)
3	SPARE (8-BIT TRANSFER)
4	CASCADE FOR DMA CONTROLLER 1
5	SPARE (16-BIT TRANSFER)
6	SPARE (16-BIT TRANSFER)
7	SPARE (16-BIT TRANSFER)

5. PAGE REGISTER ADDRESSES

TABLE 8

PAGE REGISTER ADDRESSES

PAGE REGISTER	I/O HEX ADDRESS
DMA CHANNEL 0	0087
DMA CHANNEL 1	0083
DMA CHANNEL 2	0081
DMA CHANNEL 3	0082
DMA CHANNEL 4	(NOT SHOWN)
DMA CHANNEL 5	008B
DMA CHANNEL 6	0089
DMA CHANNEL 7	008A
REFRESH	008F

Page Register Address Map

HEX ADDRESS	COMMAND CODE
0C0	CH0 Base and Current Address
0C2	CH0 Base and Current Word Count
0C4	CH1 Base and Current Address
0C4	CH1 Base and Current Word Count
0C8	CH2 Base and Current Address
0CA	CH2 Base and Current Word Count
0CC	CH3 Base and Current Address
0CE	CH3 Base and Current Word Count
0D0	Read Status Register
	Write Command Register
0D2	Write Request Register
0D4	Write Single Mask Register
0D6	Write Mode Register
0D8	Clear Byte Pointer Flip-Flop
0DA	Read Temporary Register
	Write Master Clear
0DC	Clear Mask Register
0DE	Write All Mask Register Bits

6. INTERRUPTS

TABLE 9

INTERRUPTS

LEVEL	FUNCTION
0	SYSTEM TIMER OUTPUT 0
1	KEYBOARD OUTPUT BUFFER FULL
2	INTERRUPT FROM CONTROLLER 2 (LEVELS 8-15)
3	SERIAL PORT 2
4	SERIAL PORT 1
5	PARALLEL PORT 2
6	DISKETTE CONTROLLER
7	PARALLEL PORT
8	REAL TIME CLOCK
9	SOFTWARE REDIRECTED TO INT 0AH
10	RESERVED
11	RESERVED
12	RESERVED
13	80287
14	HARD DISK CONTROLLER
15	RESERVED

7. TIMERS

TABLE 10

TIMERS

CHANNEL	FUNCTION
0	SYSTEM TIMER OUTPUT 0
1	MEMORY REFRESH
2	SPEAKER TONE

8. REAL TIME CLOCK AND CMOS RAM

A CMOS RAM chip (Motorola MC146818 AP) which keeps configuration information when the power is out, contains the real-time clock and CMOS RAM. The internal clock circuitry uses 14K of this RAM, and the rest is allotted to configuration information.

CMOS RAM Address Map

ADDRESSES	DESCRIPTION
00-0D	*Real Time Clock Information
0E	*Diagnostic Status Byte
0F	*Shutdown Byte
10	Diskette Drive Type Byte - Drives A and B
11	Reserved
12	Fixed Disk Drive Type Byte - Drives C and D
13	Reserved
14	Equipment Byte
15	Low Base Memory Byte
16	High Base Memory Byte
17	Low Expansion Memory Byte
18	High Expansion Memory Byte
19-2D	Reserved
2E-2F	2-byte CMOS Checksum
30	*Low Expansion Memory Byte
31	*High Expansion Memory Byte
32	*Date Century Byte
33	Information Flags (set during power on)
34-3f	Reserved

(*These bytes are not included in the checksum calculation and are not part of the configuration record.)

9. POWER SUPPLY

The power supply inside the system unit provides power for the system board, adapters, diskette drive(s), hard disk drive(s), monitor and keyboard.

The power supply is designed for use with IBM PC AT compatible computers. The total output is 192 watts with 115/230 Vac selectable switch at the rear of the power supply box.

Input Characteristics

The power supply can operate at a frequency of either 60 +/- 3 Hz or 50 +/- 2 Hz, and it can operate at 100 Vac to 130 Vac, 5.0 A or 220/260 Vac, 2.5 A. The voltage is selected by the switch above the power-cord plug at the rear of the power supply. The input requirements are as follows:

AC Input Voltage:

100 V to 130 V / 200 V to 260 V selectable

AC Input Frequency:

47 to 63 Hz

TABLE 11

INPUT REQUIREMENTS

RANGE	VOLTAGE	CURRENT (AMPERES)
115 VAC	MINIMUM 100 MAXIMUM 125	MAXIMUM 5
230 VAC	MINIMUM 200 MAXIMUM 240	MAXIMUM 3.0

TABLE 12

POWER SUPPLY OUTPUT

NORMAL OUTPUT	OUTPUT CURRENT
+5V	22.6 A
+12V	8 A
-5V	0.4 A
+5V	0.6 A

Output Characteristics

The power supply provides +5, -5, +12, and -12 Vdc. Table 13 shows the load current and regulation tolerance for the voltages.

NOTE: The power supply also supplies either 115 Vac or 230 Vac for the monitor.

TABLE 13

DC LOAD REQUIREMENTS

OUTPUT	LOAD	TOLERANCE	RIPPLE
+5V	20 A	+/- 2%	50MV
+12V	7.3 A	+/- 5%	100MV
-5V	0.3 A	+/- 10%	100MV
-12V	0.3A	+/- 10*	100MV

Output Protection

If any output becomes overloaded, the power supply will switch off within 20 milliseconds. An overcurrent condition will not damage the power supply.

Dummy Load

If no fixed disk drive is connected to the power supply, a dummy load must be connected to P10. The dummy load is a 5 ohm, 50 watt resistor.

Output Voltage Sequencing

Under normal conditions, the output voltage levels track within 300 milliseconds of each other when power is applied to, or removed from, the power supply, provided that at least minimum loading is present.

No-Load Operation

No damage or hazardous conditions occur when primary power is applied with no load on any output level. In such cases, the power supply may switch off, and a power-on cycle will be required. The power supply requires a minimum load for proper operation.

Power-Good Signal

The power supply provides a "power-good" signal to indicate proper operation.

When the supply is switched to OFF for a minimum of one second, then switched to ON, the "power-good" signal is generated, assuming that there are no problems. This signal is a logical AND of the DC output-voltage sense signal and the AC input-voltage sense signal.

The power-good signal is also a TTL-compatible high-level for normal operations, or a low-level for fault conditions. The AC fail signal causes power-good to go to a low level at least 1 millisecond before any output voltage falls below the regulation limits. The operating point used as a reference for measuring the 1 millisecond is normal operation at minimum line voltage and maximum load.

The DC output-voltage sense signal holds the power-good signal at a low level when power is switched on until all output voltages have reached their minimum sense levels. The power good signal has a turn-around delay of at least 100 milliseconds but not longer than 500 milliseconds. Table 14 shows the minimum sense levels for the output voltages.

TABLE 14

MINIMUM SENSE LEVELS FOR OUTPUT VOLTAGES

LEVEL (VDC)	MINIMUM (VDC)
+5	+4.5
-5	-3.75
+12	+10.8
-12	-10.4

Fan Out

Fan-out is the number of inputs that one output can drive. The power-good signal can drive six standard TTL loads.

Connectors

Table 15 shows the pin assignments for the power supply output connectors.

TABLE 15

DC LOAD DISTRIBUTION

LOAD POINT	VOLTAGE (VDC)	MAX. CURRENT (A)
PS8-1	POWER GOOD	SEE NOTE
PS8-2	+5	3.8
PS8-3	+12	0.7
PS8-4	-12	0.3
PS8-5	GROUND	0.0
PS8-6	GROUND	0.0
PS9-1	GROUND	0.0
PS9-2	GROUND	0.0
PS9-3	-5	0.3
PS9-4	+5	3.8
PS9-5	+5	3.8
PS9-6	+5	3. 8
P10-1	+12	2.8
P10-2	GROUND	0.0
P10-3	GROUND	0.0
P10-4	+5	1.8
P11-1	+12	2.8
P11-2	GROUND	0.0
P11-3	GROUND	0.0
P11-4	+5	1.8

LOAD POINT	VOLTAGE (VDC)	MAX CURRENT (A)
P12-1	+12	1.0
P12-2	GROUND	0.0
P12-3	GROUND	0.0
P12-4	+5	0.6

10. THE 80287 MATH COPROCESSOR

Socket U65 is available for the addition of an 80287 math coprocessor chip.

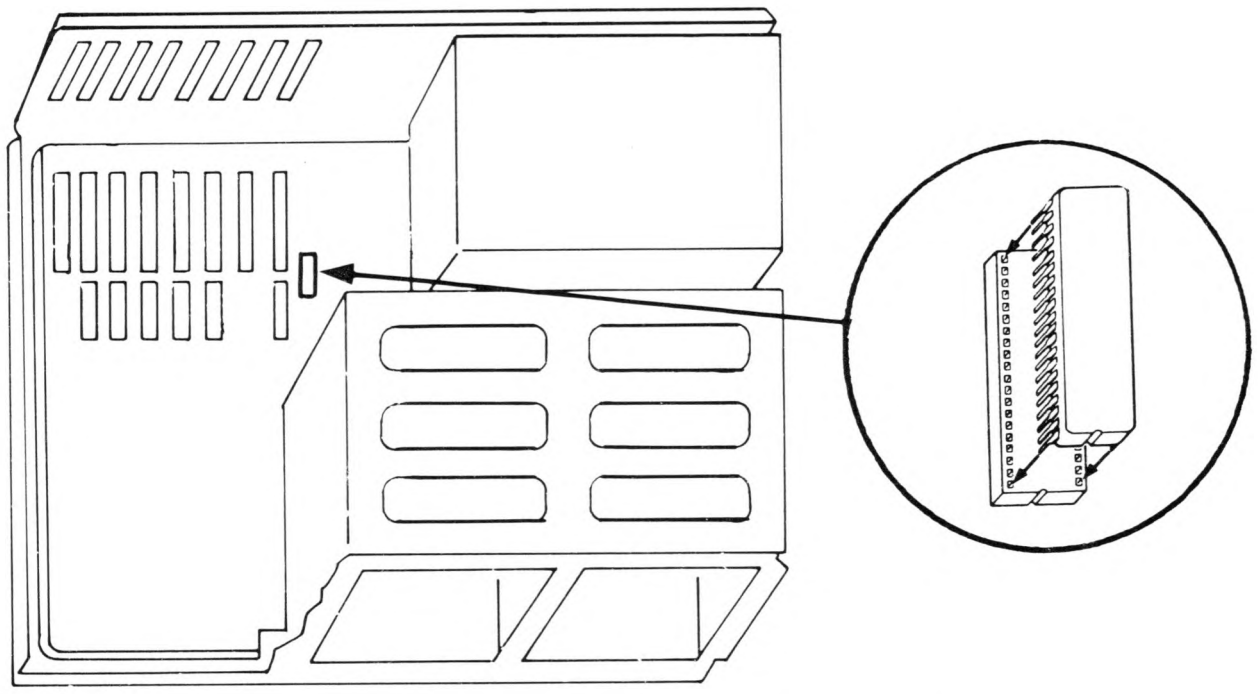


Figure 42: The 80287 in Socket U65

Figure 43 shows the correct orientation of the 80287 in the socket and the functions of each pin.

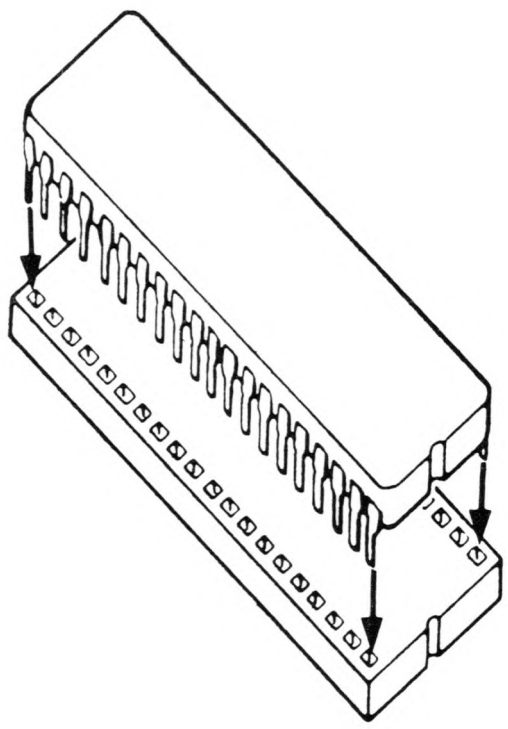


Figure 43: Orientation and Pin Functions of the 80287

SYMBOLS	TYPE	NAME AND FUNCTION
CLK	I	Clock input: this clock provides the basic timing for internal 80287 operations. Special MOS level inputs are required. The 82284 or 8284A CLK outputs are compatible with this input.
CKM	I	Clock Mode signal: indicates whether CLK input is divided by 3 or used directly. A HIGH input will indicated that CLK is to be used directly. This input may be connected to Vcc or Vss as appropriate. This input must be either HIGH or LOW 20 CLK cycles before RESET goes LOW.
RESET	I	System Reset: causes the 80287 to immediately terminate its present activity and enter a dormant state. RESET is required to be HIGH for more than 4 80287 CLK cycles. For proper initialization the HIGH-LOW transition must occur no sooner than 50ms after Vcc and CLK meet their DC and AC specifications.

SYMBOLS	TYPE	NAME AND FUNCTION
D15-D0	I/O	Data: 16-bit bi-directional data bus. Inputs to these pins may be applied asynchronous to the 80287 clock.
BUSY	O	Busy status: asserted by the 80287 to indicate that it is currently executing a command.
ERROR	O	Error status: reflects the ES bit of the status word. This signal indicates that an unmasked error condition exists.
PEREQ	O	Processor Extension data control operand transfer request: a HIGH on this output indicates that the 80287 is ready to transfer data. PEREQ will be disabled upon assertion of PEACK or upon actual data transfer, whichever occurs first, if no more transfers are required.

SYMBOLS	TYPE	NAME AND FUNCTION
PEACK	I	Processor Extension data channel operand transfer acknowledge: acknowledges that the request signal (PEREQ) has been recognized. Will cause the request (PEREQ) to be withdrawn in case there are no more transfers required.
NPRD	I	Numeric Processor Read: enables transfer of data from the 80287. This input may be asynchronous to the 8027 clock.
NPWR	I	Numeric Processor Write: enables transfer of data to the 80287. This input may be asynchronous to the 80287 clock.

SYMBOLS	TYPE	NAME AND FUNCTION
NPS1, NPS2	I	Numeric Processor Selects: indicate the CPU is performing an ESCAPE instruction. Concurrent assertion of these signals (e.g. NPS1 is LOW and NPS2 is HIGH) enables the 80287 to perform floating point instructions. No data transfers involving the 80287 will occur unless the device is selected via these lines. These inputs may be asynchronous to the 80287 clock.
CMD1, CMD0	I	Command lines: these, along with select inputs, allow the CPU to direct the operation of the 80287. These inputs may be asynchronous to the 80287 clock.
CLK286	I	CPU clock: this input provides a sampling edge for the 80287 inputs S1, S0, COD/INTA, READY and HLDA. It must be connected to the 80286 CLK input.

SYMBOLS	TYPE	NAME AND FUNCTION
S1, S0 COD/ INTA	I	Status: these inputs must be connected to the corresponding 80286 pins.
HLDA	I	Hold Acknowledge: this input informs the 80287 when the 80286 controls the local bus. It must be connected to the 80286 HLDA output.
READY	I	Ready: the end of a bus cycle is signaled by this input. It must be connected to the 80286 READY input.
Vss	I	System ground: both pins must be connected to ground.
Vcc	I	+5V supply

Appendix II: The Hard Disk Controller Card and High-Capacity Diskette Drive

Introduction

There are two models of hard disk/floppy controller that is installed in the 1800. Please refer to figure 44 and 45 to determine which controller model is in your machine. Both models feature high performance and reliability; the only difference is the arrangement of the drive connectors, jumper plugs, and chips.

The Hard Disk/Floppy Controller interfaces up to two hard disk drives of different capacities, and up to two floppy disk drives in the 1800 and other compatible computers (the host). The drive interface is based upon the Seagate Technology Model ST506 hard disk and other compatible drives. Communication with the host is accomplished via the host I/O bus.

The Hard Disk/Floppy Controllers have two separate and independent sections (hard disk and floppy) with their attendant data separator and write precompensation functions. The hard disk section also has a sector buffer. In addition, registers for control and status functions are included for each control section. Bus interface logic, I/O buffering, and timing are shared functions. Commands to one controller do not inhibit host communication to the other.

MODEL I - HARD DISK/FLOPPY CONTROLLER

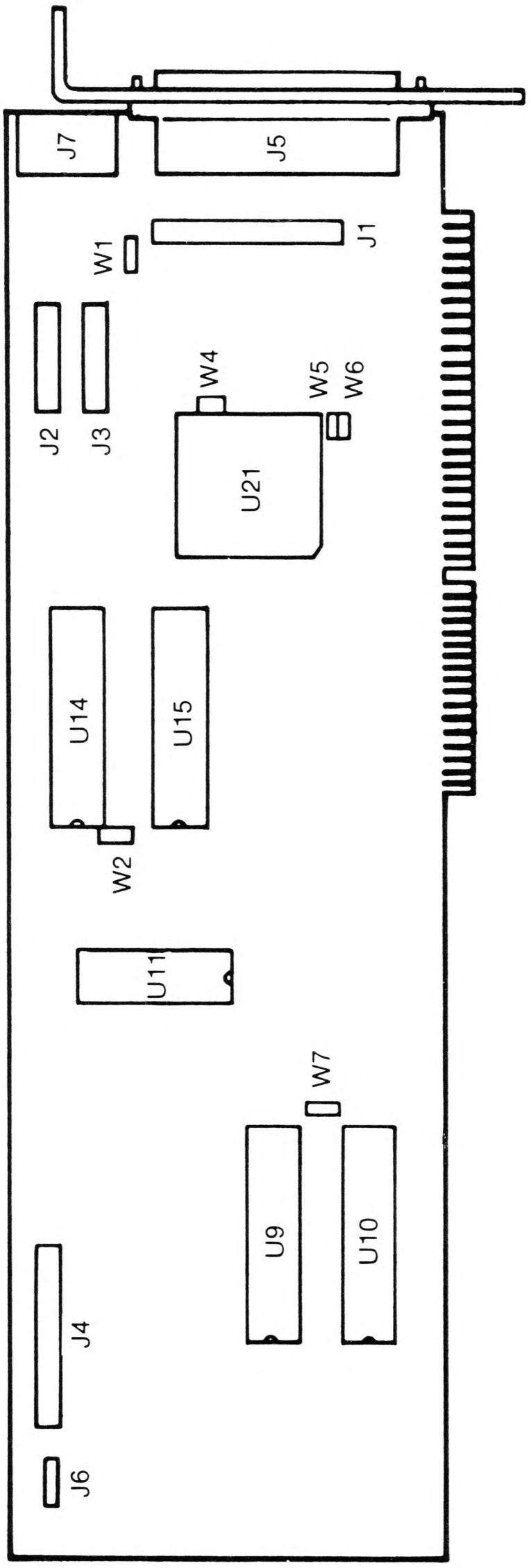


Figure 44: Model I - Hard disk/floppy controller

TABLE 16

MODEL I: CONNECTOR LOCATIONS AND FUNCTIONS

Connector		Function
J1	-	34-Pin hard disk connector. Attach a daisy-chain hard disk control cable.
J2	-	20-pin hard disk connector. Attach a 20-pin data cable for hard disk drive 1.
J3	-	20-pin hard disk connector. Attach a 20-pin data cable for hard disk drive 2.
J4	-	34-pin floppy disk connector. Attach a daisy-chain floppy disk cable.
J5	-	37-pin external connector. External hard disk drives attach a shielded round cable.
J6	-	4-pin LED connector. Attach the cable located behind the drive light panel of the AT.
J7	-	4-pin power connector. Attach a power cable from the power supply of the computer.

JUMPER PLUGS

Jumper plugs are installed on both controller models. Please refer to the appropriate model for information on the jumper plugs installed on your controller.

Model I: Jumper Plugs

Standard:

W1 - Pins 1 and 2 must always have the jumper on.

W2 - Pins 1 and 2 must always have the jumper on.

W4 - Jumper off.

W7 - Jumper off.

W5 - Jumper Off - Selects primary addresses 3F2, 3F4/3F7 hex for the floppy disk drives.

W6 - Jumper Off - Selects primary addresses 1F0/1F7 hex for the hard disk drives.

Options:

W5 - Jumper On - Selects secondary addresses 372, 374/377 hex for one floppy disk drive.

W6 - Jumper On - Selects secondary addresses 170/177 hex for the hard disk drives.

MODEL II - HARD DISK/FLOPPY CONTROLLER

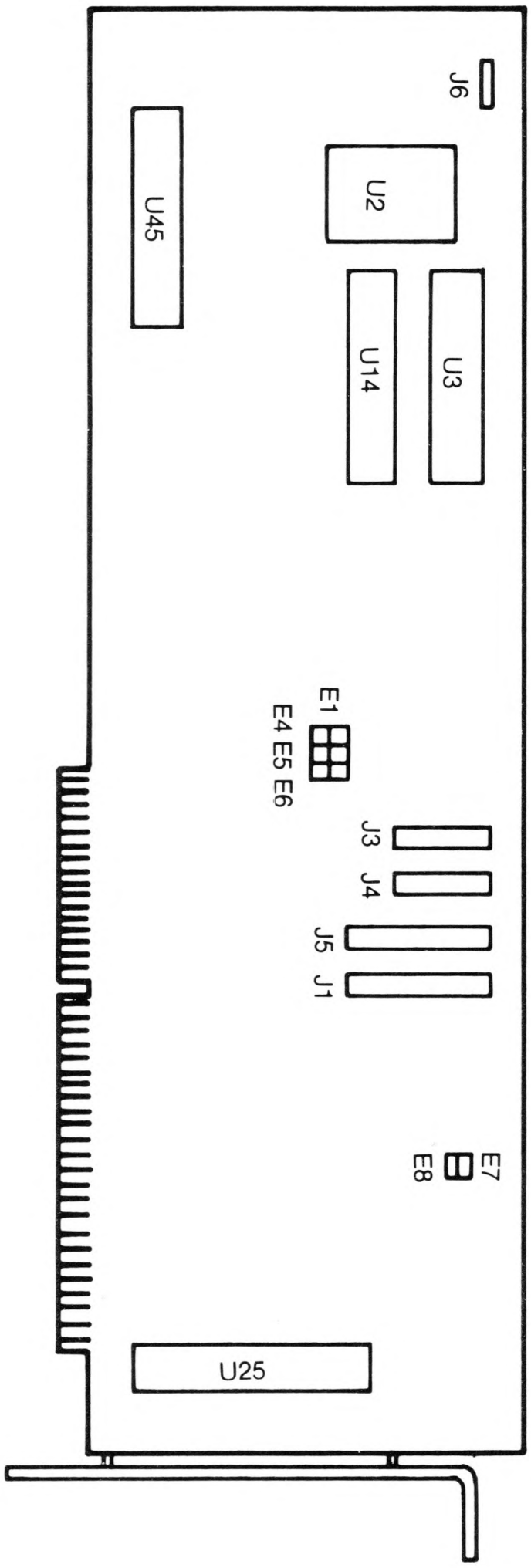


Figure 45: Model II - Hard disk/floppy controller

TABLE 17

MODEL II: CONNECTOR LOCATIONS AND FUNCTIONS

Connector		Function
J1	-	34-pin floppy disk connector. Attach a daisy-chain floppy disk cable.
J5	-	34-Pin hard disk connector. Attach a daisy-chain hard disk control cable.
J4	-	20-pin hard disk connector. Attach a 20-pin data cable for hard disk drive 1.
J3	-	20-pin hard disk connector. Attach a 20-pin data cable for hard disk drive 2.
J6	-	4-pin LED connector. Attach the cable located behind the drive light panel of the AT.

Model II: Jumper Plugs

Standard:

E1-E6 - Jumper installed.

E2-E3 - Jumper on these two pins selects primary addresses 3F2, 3F4/3F7 hex for the floppy disk drive.

E5-E6 - Jumper on these two pins selects primary addresses 1F0/1F7 hex for the hard disk drives.

E7-E8 - Jumper installed and must be left jumpered at all times.

Options:

E1-E2 - When jumpered these pins select secondary addresses 372, 374/377 hex for the floppy disk drives.

E4-E5 - Selects secondary addresses 170/177 hex for the hard disk drives.

INSTALLING A HARD DISK INTO THE 1800

This section briefly describes the installation of a hard disk into the 1800.

1. Make sure the drive select switch and the terminating resistor on the hard disk drive(s) are configured properly for your system.

   NOTE: The drive select on the hard disk drive should have the jumper on position 2 for the 1800 and other AT compatible computers.

2. Turn OFF the computer and remove the cover.

3. Remove the front screws on the AT front plate.

4. Attach the mounting rails onto the hard disk drive as shown in the following figure.

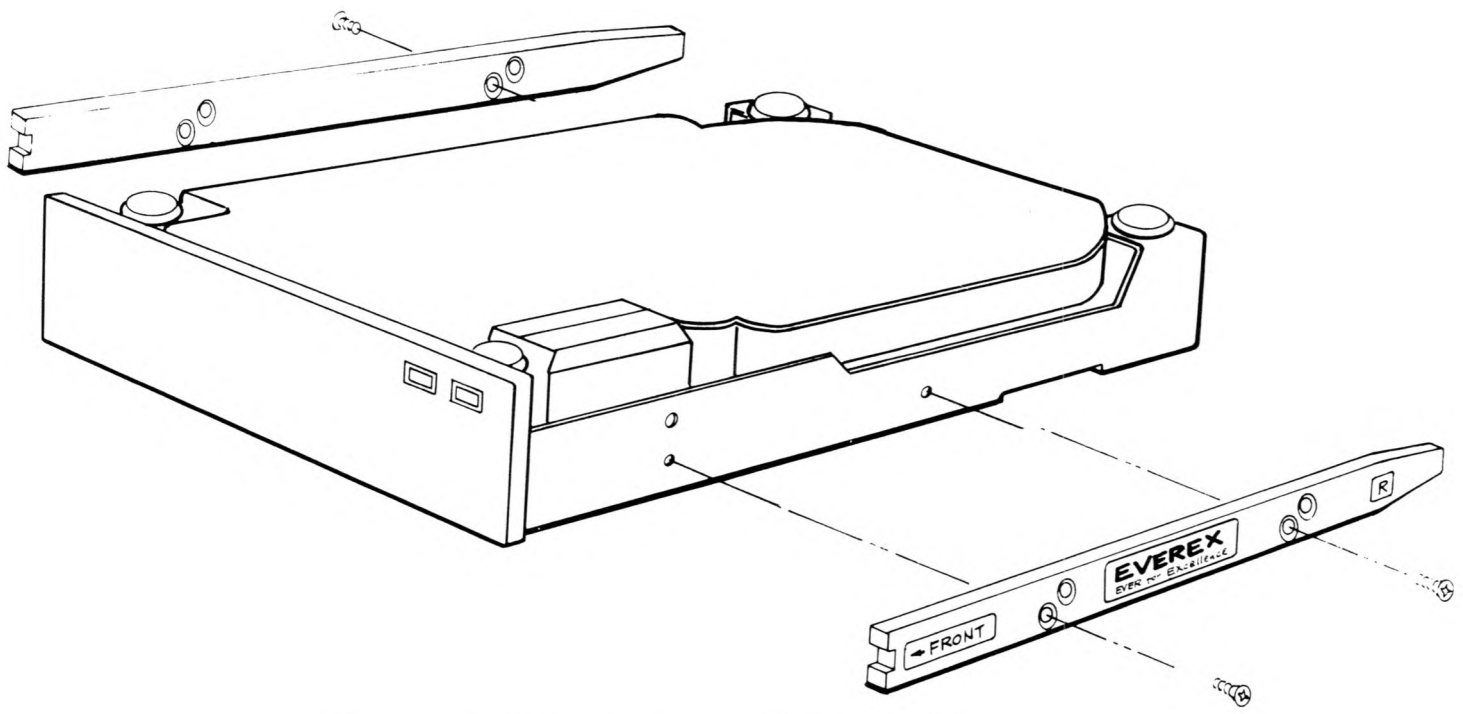


Figure 46: Mounting rails

5. Locate the 34-pin and 20-pin drive connectors on the hard disk/floppy controller. The cables should already be attached to the drive connectors. Check to be sure the colored stripe on the cables is attached to pin 1 of the drive connectors, and that all the pins are firmly inserted into the cable's connectors.

   NOTE: Refer to Figures 50A and 50B if you are uncertain about which 34-pin cable to use for the hard disk drive and the floppy disk drive. These cables are not interchangeable.

6. Locate J6 on the hard disk/floppy controller, and attach the 4-pin LED connector to J6. (The LED connector has two wires and is behind the drive light panel of the 1800.) The J6 connector is not keyed, so it works any way it is connected.

7. Slide the hard disk into the drive space with the metal cover face up. Connect the hard disk cables attached to the drive connectors (34-pin and 20-pin) to the hard disk as shown in Figure 47. The colored stripe on the cables should be on the left side as you face the front of the drive.

NOTE: The end connector on the 34-pin hard disk drive cable (the end with a twist in the cable) attaches to the hard disk designated as Drive 1, while the middle connector attaches to the drive designated as Drive 2.

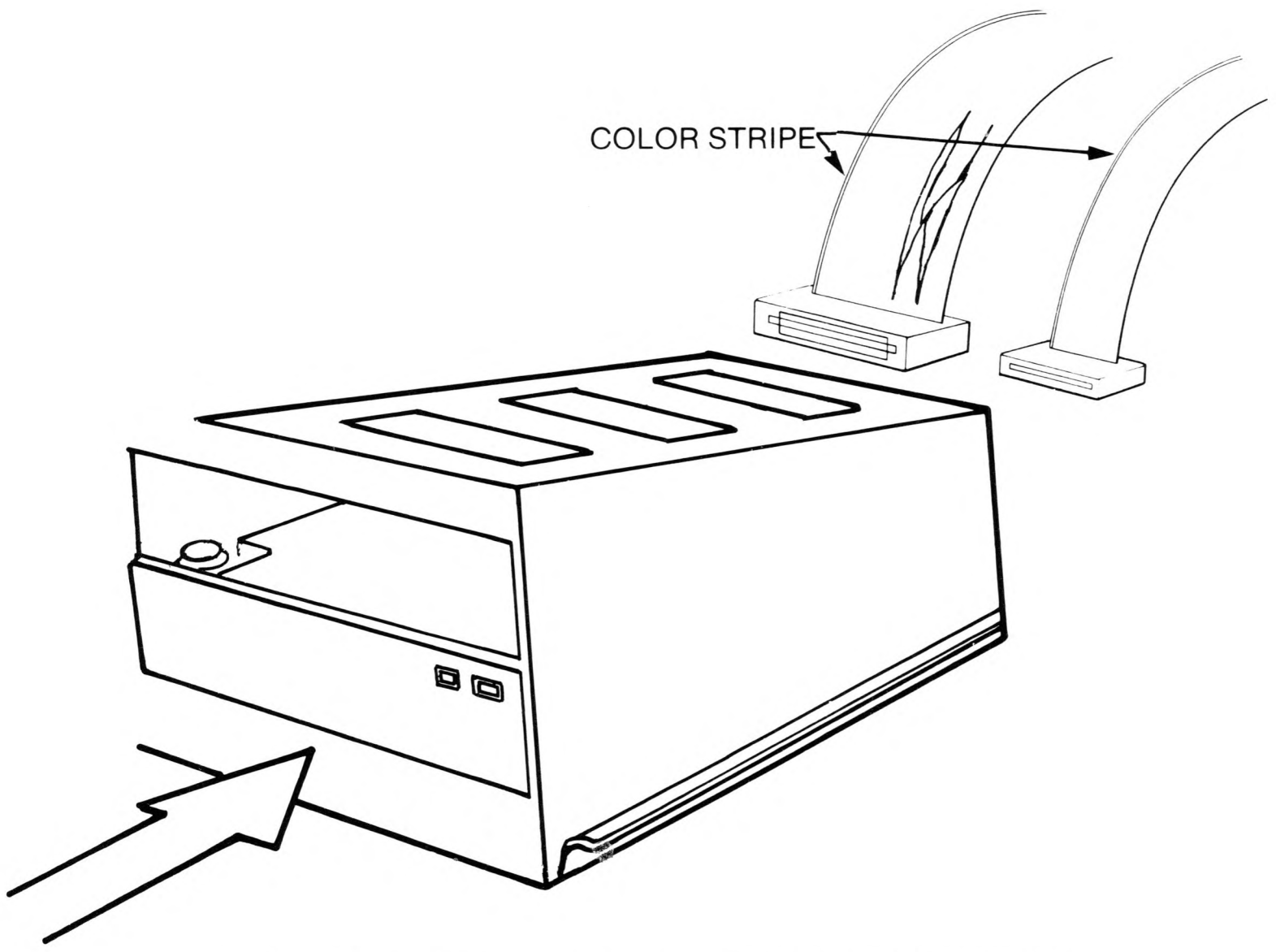


Figure 47: Installing the hard disk drive

7. Plug in a 4-pin power cable from the power supply to the connector on the hard disk drive.

8. Insert the two L-shaped brackets and the screws provided to secure the hard disk into the drive space. Refer to the following figure.

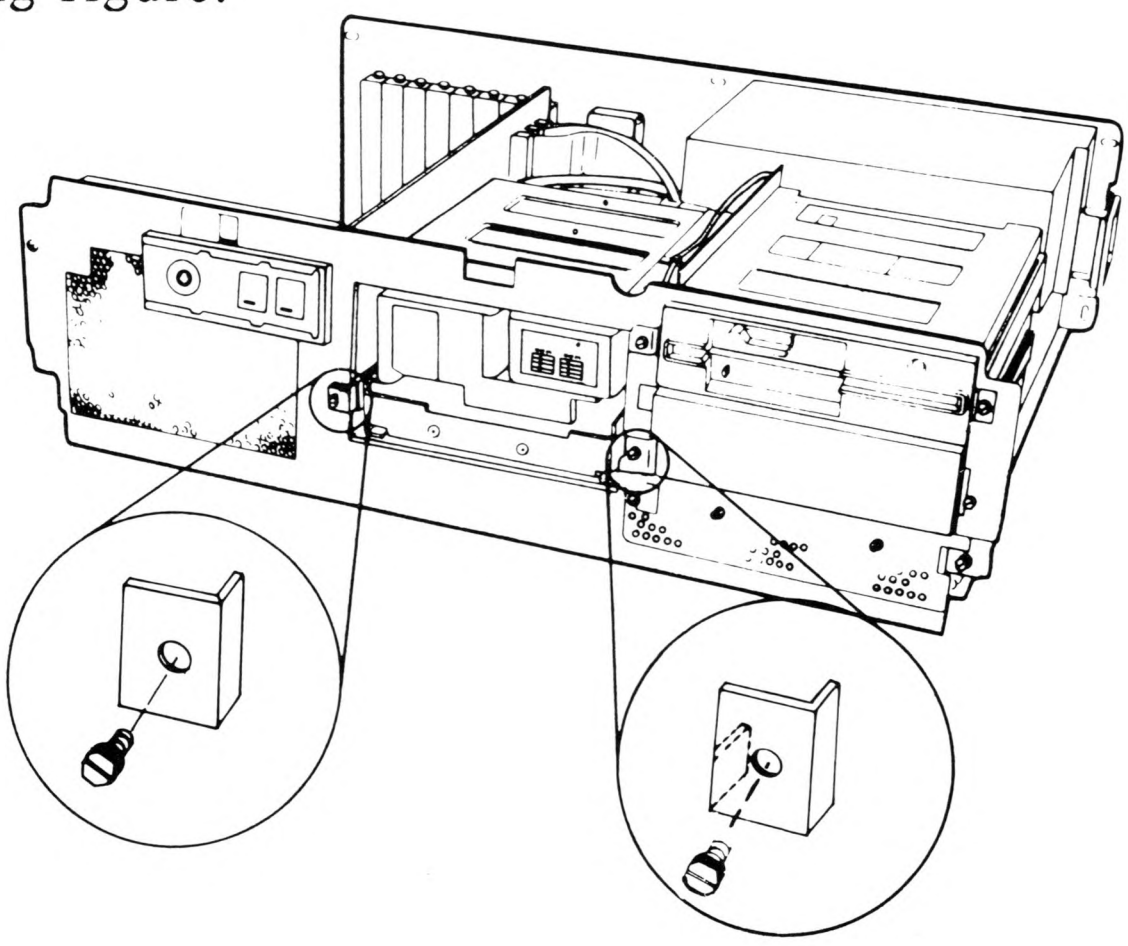


Figure 48: Securing the hard disk drive

9. Turn the computer's power ON.

10. Before you format the hard disk drive, you must run the Setup Program found on the 1800 utility diskette. Specify the drive type when you run the Setup program. Table 18 has a list of drive models and their drive type numbers.

11. Format your hard disk drive according to the instructions that came with the hard disk drive.

12. Reinstall the computer's cover when the hard disk drive is formatted and working properly.

INSTALLING TWO INTERNAL HARD DISK DRIVES INTO THE 1800

1. Set the drive select switch on the second hard disk drive.

   NOTE: The 1800 (and other AT compatibles) requires that BOTH hard disk drives have drive select 2 jumpered.

2. If it is possible, place the two hard disk drives side by side on top of the floppy disk drive or the tape drive following the instructions outlined previously in the installation instructions. Stacking the two hard disk drives on top of each other, or under the tape or floppy drive may cause the system to overheat.

3. Attach the mounting rails onto the hard disks, and slide the hard disks into the drive slots.

4. Connect the 34-pin and 20-pin cables to the hard disk drives. Refer to the subsection on Drive Connectors to differentiate the 20-pin drive 1 connector and the 20-pin drive 2 connector. The end connector of the 34-pin cable (the end with the twist) should be connected to drive 1, while the middle connector should be attached to the drive designated as drive 2. Make sure that the colored stripe on the cables is on the left side as you face the front of the drives. (See Figure 49.)

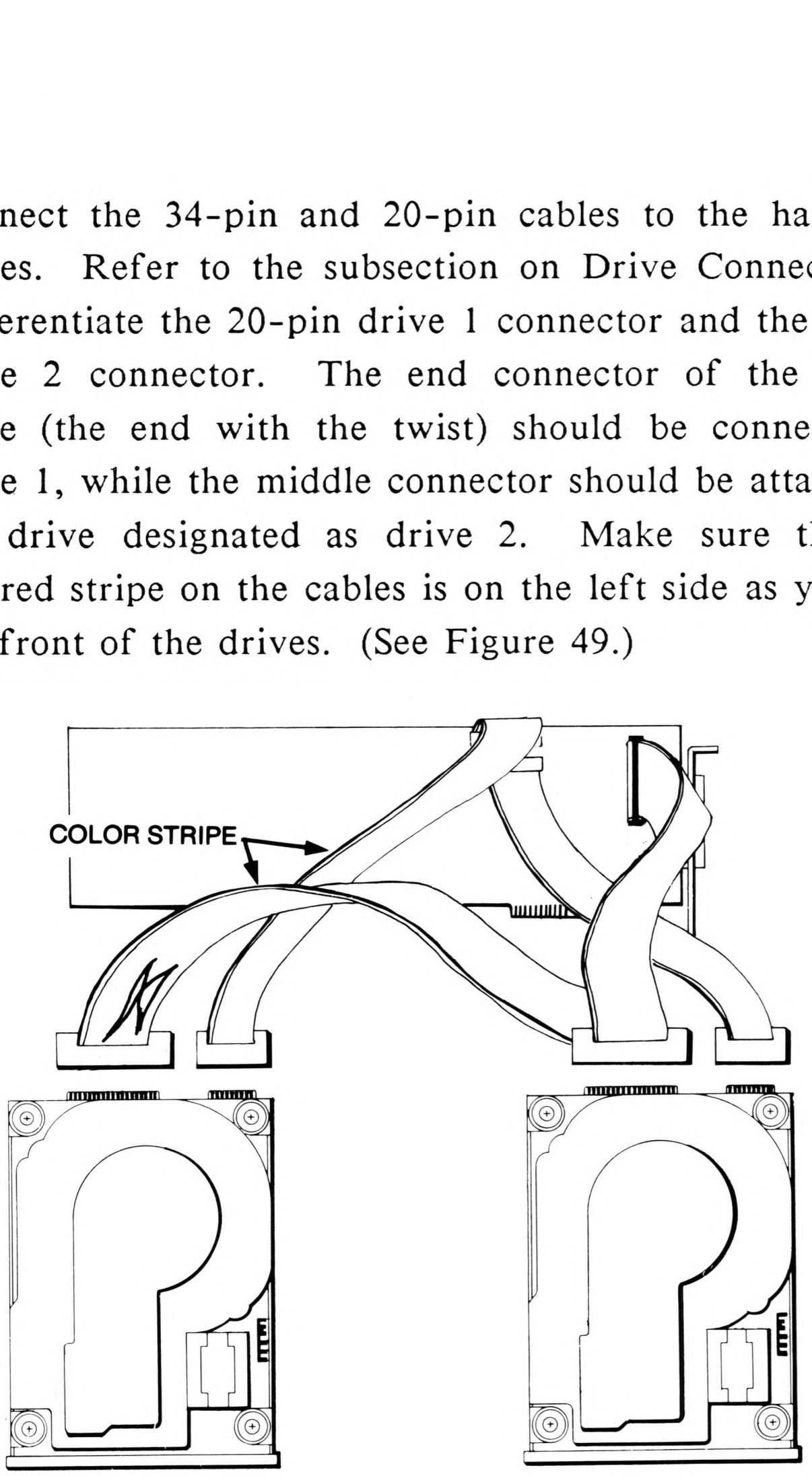


Figure 49: Installing two hard disk drives (Model I controller)

5. Connect the two hard disk drives to the power supply with the 1800's 4-pin power cables.

6. Run the Setup Program on the utility diskette to specify the hard disk drive types for both drives. Refer to Table 18 to determine the drive type number for the hard disk drives.

7. Now format the hard disk drives. Replace the cover when the drive is tested and working properly.

NOTE: The second drive will be recognized as "D".

TABLE 18
HARD DISK DRIVE TYPES FOR THE AT

Disk Type	Capacity per Drive	Examples of this Drive Type
1	10 MB	Cogito CGF912; MMI M212 and M312; Seagate ST412, ST213, and ST112; Rodime RO202; Tandon TM252 and TM502; Fujitsu M2233; Shugart 712; MiniScribe 2012 and 3412, and Microscience 612
2	21 MB	Tulin TL226 and TL326, Qume R200, Shugart 724, Seagate 225, Seagate ST4026, and Fuji FK302-26
3	31 MB	Tulin TL240 and TL340, Qume R300, Rodime RO206
4	64 MB	Atasi 3080
5	48 MB	
6	21 MB	Microscience 725, Tandon 262
7	31 MB	Quantum Q540
8	31 MB	Seagate ST4038
9	115 MB	Maxtor XT-1140
10	21 MB	Micropolis 1302, Vertex V130
11	36 MB	Vertex V150, Seagate 4051
12	51 MB	Vertex V170
13	21 MB	Seagate ST425, MMI M225 and M312, Rodime RO204, Fujitsu M2235
14	44 MB	

TABLE 19

DEFINITIONS OF PREDEFINED DRIVE TYPES

DISK TYPE	CYLINDERS	HEADS	LANDING ZONE	WRITE PRECOMP	CAPACITY PER DRIVE
1	306	4	128	305	10 MB
2	615	4	300	615	21 MB
3	615	6	300	615	31 MB
4	940	8	512	940	64 MB
5	940	6	512	940	48 MB
6	615	4	NO	615	21 MB
7	462	8	256	511	31 MB*
8	733	5	NO	733	31 MB
9	900	15	NO	901	115 MB
10	820	3	NO	820	21 MB
11	855	5	NO	855	36 MB
12	855	7	NO	855	51 MB
13	306	8	128	319	21 MB
14	733	7	NO	733	44 MB

*4 MB unused because only 426 out of 511 cylinders are used.

Capacity per drive = cylinders * heads * 17 sectors/track * 0.5 kb/sector (heads is the same as tracks/cylinders)

TABLE 20

INTERLEAVE FACTORS FOR THE AT

Manufacturer/Model	Average Access Time (ms)	Interleave
Fuji FK302-26	80	3
Microscience 612	80	3
Microscience 725	80	3
Seagate ST225	85/65	3
Seagate ST4026	40	4
Seagate ST4038	40	4
Seagate ST4051	40	4
Tandon 252	85	3
Tandon 262	80	3
Tulin 326	45	4
Tulin 340	45	4

When formatting the hard disk drives, the recommended interleave factor for drives with an average access time equal or faster than 40 milliseconds is 4; the hard disk drive with an average access time slower than 40 ms has an interleave of 3. (Refer to Table 20: Interleave Factors.) The default interleave factor is 4. To default, press the carriage return key.

IDENTIFYING THE CORRECT 34-PIN CABLE

The 34-pin connecting cables for the floppy disk drive and the hard disk drive look very similar, but they do not have the same functions, and they are not interchangeable. The following descriptions should clarify which 34-pin cable is used for each type of drive.

34-pin Floppy Disk Drive Cable

The 34-pin floppy disk cable has three connectors. The twist at one end of the floppy disk cable is close to the colored stripe on the cable. (See Figure 50A.)

34-pin Hard Disk Drive Cable

The 34-pin hard disk drive cable also has three connectors. The difference lies in the twisted end of the cable. The twist of the hard disk drive cable is further from the colored stripe. (See Figure 50B).

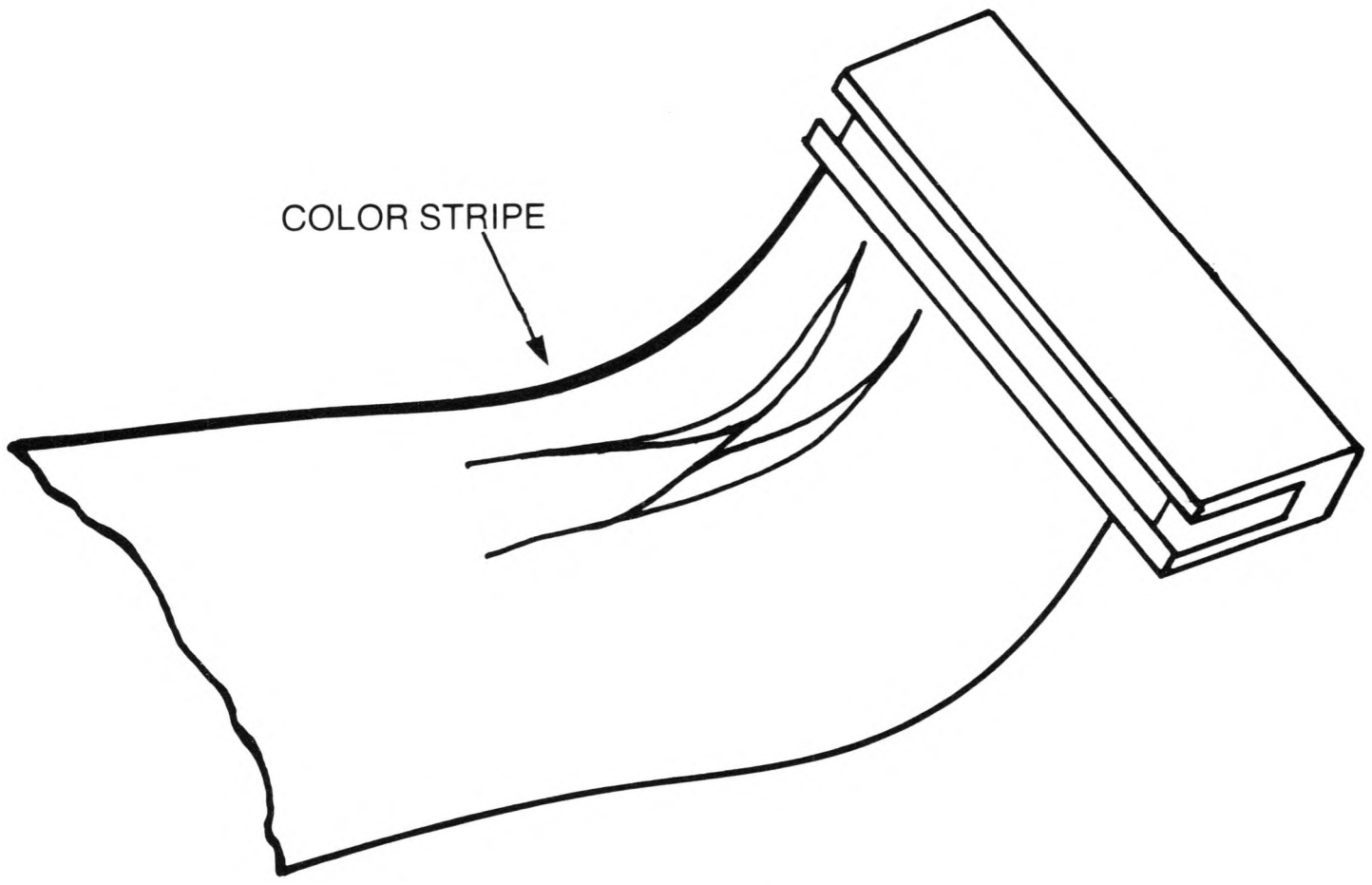


Figure 50A: Floppy Disk Drive Cable

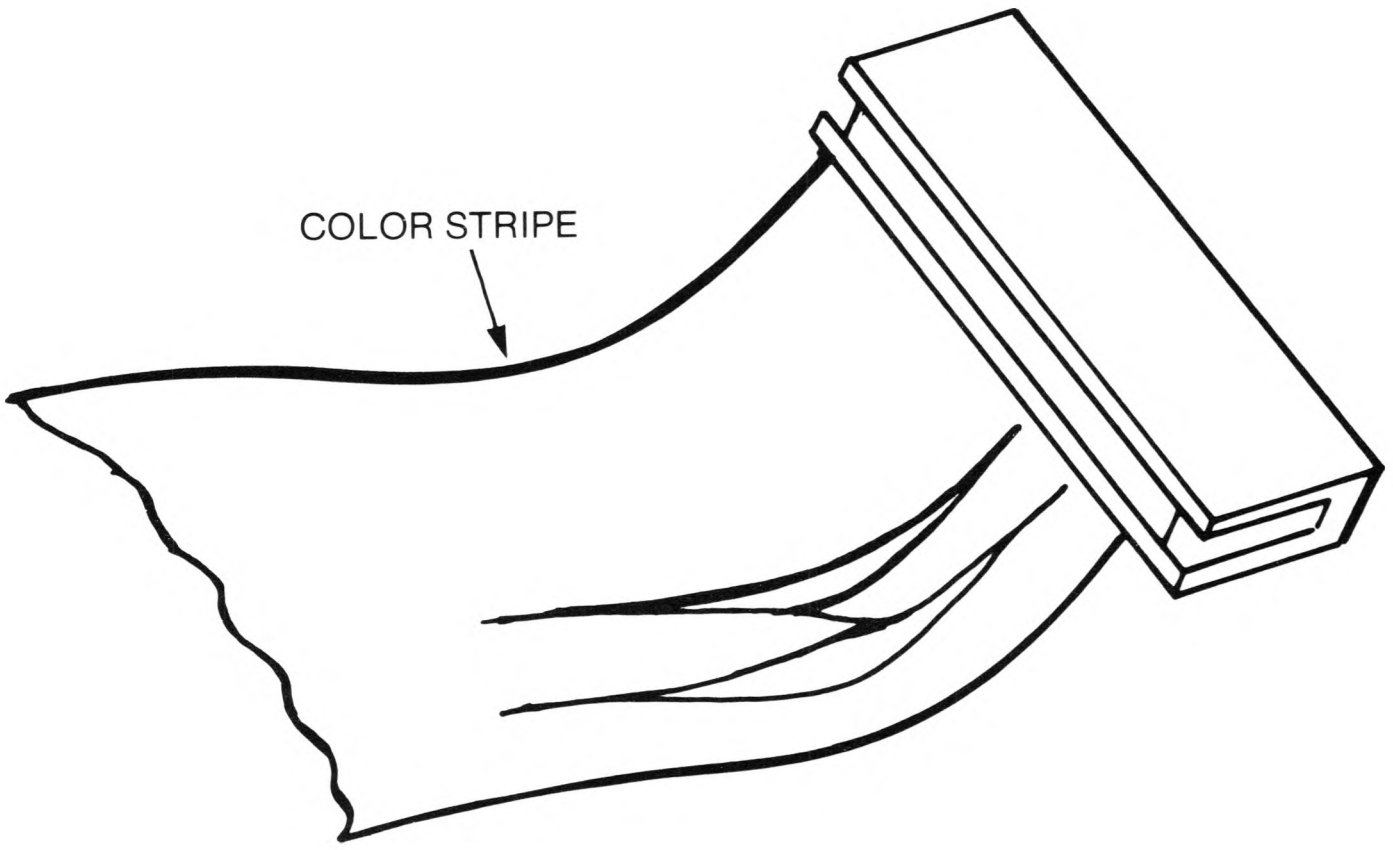


Figure 50B: Hard Disk Drive Cable

Appendix III: The Keyboard

Each key is assigned a unique 8-bit scan code which is sent when the key is pressed. Each key also sends a break code when the key is released.

Scan codes, which are received from the keyboard, are converted by the keyboard controller before they are put into the keyboard's output buffer. Table 21 shows the keyboard layout with key numbers.

1. KEYBOARD SCAN CODES

TABLE 21

SCAN CODE TRANSLATION TABLE

KEYBOARD SCAN CODE	KEY	SYSTEM SCAN CODE
00		FF
76	90	01
16	2	02
1E	3	03
26	4	04
25	5	05
2E	6	06
36	7	07
3D	8	08
3E	9	09
46	10	0A
45	11	0B
4E	12	0C
55	13	0D
66	15	0E
0D	16	0F
15	17	10
1D	18	11
24	19	12

KEYBOARD SCAN CODE	KEY	SYSTEM SCAN CODE
2D	20	13
2C	21	14
35	22	15
3C	23	16
43	24	17
44	25	18
4D	26	19
54	27	1A
5B	28	1B
5A	43	1C
14	30	1D
1C	31	1E
1B	32	1F
23	33	20
2B	34	21
34	35	22
33	36	23
3B	37	24
42	38	25
4B	39	26
4C	40	27
52	41	28
0E	1	29
12	44	2A
5D	14	2A

KEYBOARD SCAN CODE	KEY	SYSTEM SCAN CODE
1A	46	2C
22	47	2D
21	48	2E
2A	49	2F
32	50	30
31	51	31
3A	52	32
41	53	33
49	54	34
4A	55	35
59	57	36
7C	106	37
11	58	38
29	61	39
58	64	3A
05	70	3B
06	65	3C
04	71	3D
0C	66	3E
03	72	3F
0B	67	40
02 OR 83	73	41

KEYBOARD SCAN CODE	KEY	SYSTEM SCAN CODE
0A	68	42
01	74	43
09	69	44
77	95	45
7E	100	46
6C	91	47
75	96	48
7D	101	49
7B	107	4A
6B	92	4B
73	97	4C
74	102	4D
79	108	4E
69	93	4F
72	98	50
7A	103	51
70	99	52
71	104	53
7F OR 84	105	54
60	R	55

KEYBOARD SCAN CODE	KEY	SYSTEM SCAN CODE
0A	68	42
01	74	43
09	69	44
77	95	45
7E	100	46
6C	91	47
75	96	48
7D	101	49
7B	107	4A
6B	92	4B
73	97	4C
74	102	4D
79	108	4E
69	93	4F
72	98	50
7A	103	51
70	99	52
71	104	53
7F OR 84	105	54
60	R	55

KEYBOARD SCAN CODE	KEY	SYSTEM SCAN CODE
61	R	56
78	R	57
07	R	58
0F	R	59
17	R	5A
1F	R	5B
27	R	5C
2F	R	5D
37	R	5E
3F	R	5F
47	R	60
4F	R	61
56	R	62
5E	R	63
08	R	64
10	R	65
18	R	66
20	R	67
28	R	68
30	R	69
38	R	6A

KEYBOARD SCAN CODE	KEY	SYSTEM SCAN CODE
40	R	6B
48	R	6C
50	R	6D
57	R	6E
6F	R	6F
13	R	70
19	R	71
39	R	72
51	R	73
53	R	74
5C	R	75
5F	R	76
62	R	77
63	R	78
64	R	79
65	R	7A
67	R	7B
68	R	7C
6A	R	7D
6D	R	7E
6E	R	7F

Appendix IV: Moving the 1800

Before you move your system unit there are four things which must be done: prepare the floppy disk drive, "park" the hard disk drive, turn OFF the system's power, and remove all cables from the unit.

To prepare the floppy disk drive you should:

1. Remove any floppy diskette(s) from the drive(s).

2. Insert the shipping cardboard which came with the unit originally. (To protect the inside of the drive).

3. Close the floppy drive door. (To secure all of the moving pieces in the drive).

To prepare the hard disk drive you will need to run a head positioning program. This program will secure the moving parts in the hard disk drive. Follow the instructions the manual which accompanied your hard disk drive.

Once your drives are secured, you should turn OFF the system's power and remove all cables from the back of the unit.

Notes

EVEREX SYSTEMS, INC.
48431 MILMONT DRIVE
FREMONT, CA 94538

(415) 498-1111
FAX: (415) 651-0728
TELEX: 5101000590

ADDENDUM: CMOS SETUP IN THE BIOS

The 1800 System no longer requires a utility diskette. One of the more advanced features of the 1800 system is the built-in CMOS SETUP BIOS on the system board. Most 16-bit systems require a configuration program that is shipped on a floppy diskette, however, your new 1800 system has a configuration program called CMOS SETUP built into the BIOS!

The BIOS on the system board of the 1800 can sense the configuration of the computer. For example, it knows whether you have attached a color or a monochrome monitor, how much memory is installed, and how many and what kind of floppy disk drives you run. The only things you need to tell your system is the time, date and hard disk drive type.

When your system is powered up a message similar to the following appears on your screen:

Press DEL key to run SETUP utility.

You have two choices:

1. Do NOT press the delete [Del] key if you want the system to boot-up. The system will first do a memory check and then boot-up. If you want to save time, press the [ESC] key to bypass the memory check.

2. Press the Delete [Del] key for a first time installation or if you have installed a hard disk drive or any new peripherals into your system. If you press the [Del] key, answer the questions the SETUP program will prompt you for. Refer to the following instructions for help if necessary.

Instructions For Using the SETUP Program:

1. Press the [Del] key as soon as the message "Press <DEL> key to run SETUP utility" appears. A message similar to the following then appears:

   Want to run SETUP utility (Y/N)?

   Press Y and the [ENTER] key.

2. The SETUP program prompts you for the correct time and date with a display *similar* to the following:

   1. Current date is: 01-01-1987
   Enter new date (MM-DD-YYYY)?

   2. Current time is: 18:04:26
   Enter new time (HH:MM:SS)?

Press the [ENTER] key if the time and date are correct. If the time and date are not correct, enter the accurate values. Remember to use 24-hour military time in setting the clock (for example, 3:30 pm equals 15:30 in 24-hour time).

3. The program senses the type of monitor, the floppy disk drive(s), and the base memory installed in the 1800. No response is required if you have a monochrome monitor. If you have a color monitor, the SETUP program will display a message similar to the following:

   Primary Display is: Color Display
   Enter Screen Width (80 or 40)?

   Enter the value of the screen width that you want. When the system is re-booted, the width you indicate here will appear.

4. The next message on the screen is similar to the following:

   Enter Disk Drive C type (1 - 47)?
   Enter Disk Drive D type (1 - 47)?

   If a hard disk is not installed, press the [ENTER] key.

For more information on the hard disk drive types press the escape [ESC] key. Drive C is the logical designation for one physical hard disk, and Drive D is the logical designation for a second physical hard disk.

5. When you press the ESC key a list of drive types appears. The drive type number informs the 1800 system the physical specifications of the hard disk drive. The specifications include the number of cylinders, the number of read/write heads, the write precompensation, the landing zone, and the capacity (in megabytes) of the hard disk drive. You will find these specifications in the documentation that accompanied your hard disk drive. Find the number of the drive type that has the specifications that match those of your drive.

NOTE: Only drive types 1 through 23 appear on the screen after you press the [ESC] key. Drive types 24 through 44 are described in Table A-1 which accompanies this addendum.

6. When you have finished changing the values in the SETUP program, the last message on the display reads something like the following:

Are these values correct (Y/N)?

Press Y and the [ENTER] key if everything is correct. Your system will then re-boot.

Press N and the [ENTER] key if you want to change the time, date, or hard disk drive type. Enter the correct values following steps 1 through 6 again. Press the [Y] key after you have made your corrections and the system will re-boot.

7. Congratulations! Your 1800 computer is correctly setup.

TABLE A-1
Additional Hard Disk Drive Types
(Not Displayed in the SETUP Software)

Drive Type	Cylin	Heads	Write P-comp	Land Zone	Cap Mb	Model
24	925	7	0	925	56	CDC 94155-67
25	925	9	0	925	72	CDC 94155-86
26	754	7	754	754	46	Fujitsu M2242AS
27	754	11	754	754	72	Fujitsu M2243AS
28	699	7	256	256	42	Hitachi DK511-5
29	823	10	823	823	71	Hitachi DK511-8
30	918	7	918	918	55	Maxtor XT-1065
31	1024	11	1024	1024	98	Maxtor XT-2140
32	1024	15	1024	1024	133	Maxtor XT-2190
33	1024	5	1024	1024	44	Micropolis 1323A
34	612	2	128	612	10	Miniscribe 3212
35	1024	9	1024	1024	80	Seagate ST4096
36	1024	8	512	1024	71	Miniscribe 6085
37	615	8	128	615	42	NEC 5146
38	987	3	987	987	25	Priam/Vertex V130
39	987	7	987	987	60	Priam ID60 V170
40	820	6	820	820	42	Seagate ST251
41	977	5	977	977	42	Seagate ST4051
42	981	5	981	981	42	Tandon TM755
43	830	7	512	830	50	Toshiba MK54FA
44	830	10	512	830	72	Toshiba MK56FB

This table is for reference purposes only. We reserve the right to make changes at any time.